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REPORT OF PROGRESSIVE SPEED, MANEUVERING, ENDURANCE AND FUEL ECONOMY TRIALS OF THE

G.T.V. WILLIAM PATTERSON

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UMITED STATES DEPARTMENT OF COMMERCE

U.S. MARITIME ADMINISTRATION

REPORT

of

PROGRESSIVE SPEED, MANEUVERING, ENDURANCE AND FUEL ECONOMY TRIALS

of the

G.T.V. WILLIAM PATTERSON
Design - EC2-G-8g

1957

Conversion Contractor
Bethlehem Steel Company
Baltimore Yard
Baltimore, Maryland

For Official Distribution

LETTER OF TRANSMITTAL

DEPARTMENT OF COMMERCE
U.S. MARITIME ADMINISTRATION

Trial and Guarantee Survey Boards

Washington, D. C.

To: The Administrator, Maritime Administration
Via: Chief, Office of Ship Construction

The report of the trials of the converted and reactivated Liberty Cargo Vessel, the G.T.V. WILLIAM PATTERSON, M.C.E. Hull No. 48, which was accepted by the Maritime Administration on September 14, 1957, is submitted herewith.

R. S. Brierley
Chairman

F. H. Van Riper
Member

A. T. Leonard
Member

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MARITIME ADMINISTRATION

Trial and Guarantee Survey Boards

G.T.V. WILLIAM PATTERSON - MCE Hull No. 48

REPORT OF TRIALS

References: (a) Contract No. MA-1078 dated August 9, 1955 between the United States of America acting through the Department of Commerce, Maritime Administration, and Bethlehem Steel Company for the conversion of a single screw vessel, design EC2-S-C1, M.C.E. Hull No. 48, to a vessel, design EC2-G-8g (Gas Turbine) vessel.

(b) Contract No. MA-895 dated October 31, 1955 between the United States of America acting through the Department of Commerce, Maritime Administration, and General Motors Corporation, Cleveland Diesel Engine Division, for the furnishing to the Administration of the gas turbine required for the vessel.

(c) Plans and Specifications for Conversion and Re-activation of a Single Screw Cargo Vessel, Design EC2-G-8g, free piston gas turbine vessel, dated May, 1955

(d) Approved changes under the contract.

(e) Acceptance Survey Report dated September 20, 1957

Section I

Introduction

The G.T.V. WILLIAM PATTERSON is the fourth Liberty Ship converted and reactivated for the Maritime Administration as part of the vessel improvement program. The work on the vessel was accomplished by the Bethlehem Steel Company, Baltimore Yard, Baltimore, Maryland, where a dock trial was held on Monday, August 19, 1957. A builder's trial was conducted in the Chesapeake Bay on August 22, 1957. The official sea trials were conducted at sea off the Virginia Capes on September 4, 5 and 6, 1957. The vessel was drydocked on October 17, 1955 for conversion work, and on June 7, 1956 and April 25, 1957 for cleaning and painting.

From observations and inspection during the trials, the Boards consider that the G.T.V. WILLIAM PATTERSON is acceptable in accordance with the terms of the above contracts, subject to compliance with the requirements of the Acceptance Survey Report, reference (e).

Representatives Present

Maritime Administration Trial Board

D. S. Brierley - Chairman
F. H. Van Riper - Member
A. T. Leonard - Member

Temporary Members of the Board

C. Tangerini - Division of Ship Design
T. M. Christian - " " " "
J. Boxer - " " " "
J. D. Hayden - Division of Engineering
D. E. Specht - " " "
W. C. Bullock - Office of Ship Construction
G. G. Sammis - " " " "
C. L. Hunter - U.S.C.G. - Loran operator
A. Tait - " " "
J. C. Carpenter - David Taylor Model Basin

Maritime Administration Personnel

L. C. Hoffmann, Acting Chief, Office of Ship Construction
W. H. Beattie, Construction Representative
M. Smith, Construction Inspector
R. Blafield, " "
B. Grady, " "
F. Jaskulski, Division of S.R. & M., Baltimore, Md.
Lt. R. A Labdon, U. S. Merchant Marine Academy
J. Ramerez, Cadet, " " " "
E. Scharar, " " " " "

Bethlehem Steel Company (Key Highway Yard)

R. Leaf - Assistant to Manager
R. Chaney - Ship Superintendent
L. Van Ael - Foreman
A. Kowalski - "
W. Lears -

Bethlehem Steel Company (Key Highway Yard) - Cont'd

W. Burk - Project Engineer
E. Adler - Testing Department
R. Douglas - C.T.D., Quincy, Mass.
C. Banke - First Aid Man

General Motors - Cleveland Diesel Division

T. Hughes - General Manager
H. W. Barth - Chief Engineer
H. R. Heinzen - Asst. Chief Engineer
R. W. Talder - Project Engineer
B. R. Gommel - General Service Manager
S. W. Baltes - Project Manager
J. McKane - Service Representative
J. Petkash - Service Representative

General Motors - Research

A. Underwood - Manager of Staff Activities
G. Flynn, Jr. - Mechanical Development Department

General Motors - Electro-Motive Division

R. Becker - Project Engineer

Sigma-Seme

A. Moiroux - Design Engineer
L. Bidot - Field Service Engineer
M. Barthalon - Factory Manager
R. Huber - Dir. Engineer

Alsthron Turbine Manufacturing Co.

O. Coury - Field Service Engineer

American Bureau of Shipping

R. F. English - Baltimore Office

Lykes Bros. Steamship Company

C. J. Spatz - Asst. Manager
H. S. Clark - Surveyor
J. Macdonald - Prospective Master, G.T.V. "William Patterson"
L. Howard - " Chief Engineer, " "
C. Smith - " 1st Asst. Engineer, " "
L. Lisi - " 1st Mate, " "

J. J. Henry, Inc.

M. Bannister - Guest

Vendors

R. Hoard - Western Gear Corporation
D. Swift - " " "
J. Minnick - Shell Oil Company
C. Kopeck - Mackay Radio and Telegraph Co.
A. Geiflen - Sharples Corporation
J. Messier - Combustion Engineering Corp.
R. Crane - " " "

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DRAFTS, DISPLACEMENT AND BALLAST CONDITIONS FOR OFFICIAL SEA TRIALS

Drafts leaving from dock:

Forward - 14'-0"
Aft - 22'-0"
Mean - 18'-0"
Displacement - 8,920 Tons

Ballast Conditions

Forepeak	Full	Fresh Water
No. 1 Double Bottom	Full	Fuel Oil
No. 2 Double Bottom	224.4 Tons	Fuel Oil
No. 3 Double Bottom	179.0 Tons	Diesel Oil
No. 4 Double Bottom	111.6 Tons	Fresh Water
No. 5 Double Bottom	177.0 Tons	Fuel Oil
No. 6 Double Bottom	80.3 Tons	Fuel Oil
No. 1 Deep Tank	231 Tons	Fresh Water
No. 2 Deep Tank	Full	Fresh Water
No. 3 Deep Tank	Full	Fresh Water
After Peak	Full	Fresh Water
Port and Starboard Settlers	80.0 Tons	Fuel Oil
No. 5 Hold	292.0 Tons	Fresh Water
Potable Water Tanks	Full	Potable Water

LOG OF EVENTS

Wednesday, September 4, 1957

0755 - Tug "Fells Point" alongside
0805 - Departure, East side, Pier No. 1, Lower Yard, Bethlehem Steel Co.
0820 - Full ahead at 80 R.P.M. of propeller
0930 - Reduced speed to 50 R.P.M. to enable photographer to take pictures from launch
0950 - Full ahead at 90 R.P.M. proceeding to "Bloody Point" light
1028 - Conducting "Right Circle test"
1048 - Conducting "Left Circle test".
1108 - Repeated "Left circle test" due to heavy ship traffic in area
1115 - Finished circle tests
1200 - Reduced speed to 70 R.P.M. Repaired water leak at nipple of No. 1 gasifier
1300 - Conducted "Ahead steering test".
1310 - Conducted "Z" maneuver
1330 - Started 6000 S.H.P. run with all auxiliaries in operation
Ave. R.P.M. - 99.3
Ave. S.H.P. - 5668
1530 - Finish run. Changed over to diesel fuel
1600 - Start 6000 S.H.P. run on diesel fuel
Ave. R.P.M. - 92.0
Ave. S.H.P. - 4636
1800 - Finished run on diesel fuel
1805 - Demonstrated turbine and gasifier control system from pilot house control. Crash stop astern from 90 R.P.M. ahead. Time to stop shaft 30 seconds.
From stop shaft to 60 R.P.M. astern - 1 minute - 50 seconds
From stop shaft to 68 R.P.M. astern - 2 minutes - 20 seconds
1815 - Finish remote control operation. Changed back to control from engine room
1830 - Proceeding at 40 R.P.M. ahead. Conducted "Emergency steering tests"
1840 - Conducted torsionmeter shaft drag - ahead
1850 - Shaft stopped
1856 - Conducted torsionmeter shaft drag - astern
1929 - Conducted torsionmeter shaft drag - astern two additional times due to erratic readings.
1930 - Finished astern drag test, full speed ahead, proceeding to a destination approximately 90 miles east of Cape Henry

Thursday, September 5, 1957

0515 - On Loran course, steering 36°
0530 - Start maximum S.H.P. run base course 36°
Wind direction - west; wind force - 3; moderate sea
Weather - overcast; barometric pressure - 29.90 Hg.; air temperature 76°F; Average S.H.P. - 6056; Average R.P.M. - 101.6; Average speed - 16.66 knots.

Thursday, September 5, 1957 (Cont'd)

0635 - Base course 216°; Weather and sea conditions unchanged. Average S.H.P. - 6120; average R.P.M. - 101.7, average speed 16.8 knots

0745 - Base course 36°; Wind direction - north; wind force - 3; Sea - slight - north; weather - overcast; Barometer pressure - 29.92" Hg; Air temperature - 78°F.

1100 - Base course - unchanged at 36°; wind direction - north; wind force - 4; moderate sea; seather - clear; Barometer pressure - 29.92" Hg; air temperature - 80°F; Average S.H.P. - 6108; Average R.P.M. - 102.2; Average speed - 16.1 knots

1135 - Base course - 216°; weather conditions - unchanged; average S.H.P. - 6115; average R.P.M. - 102.2; average speed - 17.5 knots.

1200 - Finished maximum power runs

1205 - Reduced power to conduct 4000 S.H.P. run. Secured No. 1 gasifier. Closed starboard turbine outboard valve.

1225 - Started 4000 S.H.P. run. Base course - 216°; weather - unchanged; average S.H.P. - 3970; average R.P.M. - 89.6; average speed - 15.8 knots

1325 - Base course - 36°; weather unchanged; average S.H.P. - 4050; average R.P.M. - 89.8; average speed - 14.8 knots

1430 - Finish 4000 S.H.P. runs

1435 - Secured No. 4 gasifier and closed the port turbine outboard valve

1450 - Started 2000 S.H.P. run

1455 - No. 2 gasifier stopped, unable to complete 2000 S.H.P. run

1515 - Steering base course - 216°

1540 - Started "Power Range Trial". Secured Nos. 1, 2 and 4 gasifiers. Closed port turbine outboard valve. Wind direction - NNW; wind force - 4; weather - clear; barometric pressure - 29.95" Hg; air temperature - 73° F; average S.H.P. - 1670; average R.P.M. - 66.9; average speed - 11.75 knots

1640 - Finished "Power Range Trial"

1645 - Secured Nos. 1 and 4 gasifiers. Closed starboard turbine outboard valve. Closed port turbine outboard valve.

1705 - Started 2000 S.H.P. run. Base course - 216°; weather - unchanged; barometric pressure - 29.95" Hg; air temperature - 78°F; average S.H.P. - 2006; average R.P.M. - 71.2; average speed - 12.05 knots

1805 - 2000 S.H.P. run continued. Base course - 36°; wind direction - NE; wind force - $2\frac{1}{2}$; moderate sea; weather - clear; barometric pressure - 29.95" Hg; air temperature - 78°F; average S.H.P. - 2002; average R.P.M. - 71.1; average speed - 12.05 knots

1905 - Finished 2000 S.H.P. runs

1910 - Changed over from bunker "C" to diesel fuel

1920 - Reduced speed to 40 R.P.M.

1940 - Conducted torsionmeter shaft drag in the ahead direction

2005 - Conducted torsionmeter shaft drag in the astern direction

Thursday, September 5, 1957 (Cont'd)

2009 - Finished drag tests

2015 - Conducted anchor windlass test.
Let go starboard anchor with four shots of anchor chain

2018 - Let go port anchor with four shots of anchor chain

2020 - Heaved in both anchors separately to 15 fathoms. Broke upper half bearing caps at crankshaft journals while lowering anchors under power. Necessary to make a temporary repair by using a strong back and spare cap. Test incomplete

2310 - Port and starboard anchors stowed.
Vessel under way for pilot station at Cape Henry

Friday, September 6, 1957

0745 - Proceeding up Chesapeake Bay. Conducted 4000 S.H.P. run.
Steering 353°-18°; wind direction - east; wind force - $2\frac{1}{2}$; weather - calm and clear; barometric pressure - 30.00" Hg; air pemperature - 75°F; average S.H.P. - 3994; average R.P.M. - 87.2

0900 - Finished 4000 S.H.P. run

0905 - Increased speed to 98 R.P.M.

0925 - Conducted "Crash stop astern". Maximum astern R.P.M. - 70.

0930 - Continued astern run

0935 - Conducted "Astern steering test".

0950 - Reduced speed to 65 R.P.M.

1000 - Reduced speed to 60 R.P.M.

1030 - Conducted "Crash stop ahead"

1035 - Proceeding ahead at 85 R.P.M.

1040 - Conducted "Power range trials"

1050 - No. 2 gasifier secured - Steering 350°
Barometric pressure - 30.02" Hg; air temperature - 75° F; average S.H.P. - 3834; average R.P.M. - 87.4

1150 - Finished "Power Range Trial"

1200 - Secured Nos. 2 and 3 gasifiers
Closed port turbine inboard valve

1210 - Started "Power Range Trial". Steering - 370°
Weather - unchanged; average S.H.P. - 2648; average R.P.M. - 77.3

1310 - Finished "Power Range Trials"

1320 - Secured Nos. 2, 3 and 5 gasifiers
Closed both valves of port turbine

1330 - Started "Power Range Trial". Steering - 347°; weather - unchanged; average S.H.P. - 2529; average R.P.M. - 76.5

1430 - Finished "Power Range Trial"

1450 - Running six (6) gasifiers, all turbine valves open.

1525 - Operating at 90 R.P.M. ahead, demonstrating remote control operation from bridge control. In moving control, lost five (5) gasifiers

Friday, September 6, 1957 (Cont'd)

1535 - Five (5) gasifiers running
1600 - Six (6) gasifiers running
1602 - Crash stop astern - Remote control from wheelhouse.
90 R.P.M. ahead to stopped shaft - 23 seconds
0 R.P.M. to 10 R.P.M. astern - 26 seconds
0 R.P.M. to 20 R.P.M. astern - 28 seconds
0 R.P.M. to 30 R.P.M. astern - 37 seconds
0 R.P.M. to 40 R.P.M. astern - 55 seconds
0 R.P.M. to 50 R.P.M. astern - 65 seconds
1604 - Crash stop ahead
60 R.P.M. astern to stopped shaft - 8 seconds
0 R.P.M. to 40 R.P.M. ahead - 12 seconds
0 R.P.M. to 60 R.P.M. ahead - 18 seconds
0 R.P.M. to 80 R.P.M. ahead - 40 seconds
1608 - Changed back to engine room control
1610 - Full speed ahead - 96 R.P.M.
1740 - Half speed ahead
1825 - Tug "Wotoco" alongside
1830 - Tub "J. P. Pulliam" alongside
1855 - Alongside East Side Pier No. 1, Lower Yard, Bethlehem Steel Co.
1900 - Finished with engines.

Drafts on arrival - Forward 13'-9"
Aft 21'-10"
Mean 17'-9½"
Displacement 8,825 Tons

SECTION II

THE HULL

Its Characteristics, Arrangements, Auxiliaries
Equipment and Tests

Introduction

The G.T.V. WILLIAM PATTERSON (Design EC2-G-8g) powered by a free piston gas turbine, is the fourth of the four Liberty ships reactivated and converted under the experimental program for repowering Liberty ships undertaken by the Maritime Administration in 1954. The purpose of this program is two-fold - to determine what potential national defense value can be placed on the Liberty ships now in the Reserve Fleet, and to determine the practical possibilities of new propulsion equipment.

The ship was originally built by the Bethlehem-Fairfield Shipyard, Baltimore, Maryland, and was delivered on July 13, 1942. The reactivation and conversion was accomplished by the Bethlehem Steel Company Key Highway Yard, Baltimore, Maryland.

The free piston gas turbine equipment was furnished by the General Motors Corporation, Cleveland Diesel Engine Division, under a separate contract with the Maritime Administration, and was installed by the Bethlehem Steel Company.

The ship, with its conversion equipment and propelling machinery, was converted under special survey by the American Bureau of Shipping, and is distinguished as of the highest class in the Bureau's Record Book by the symbols ✠ A-1Ⓔ, ✠ AMS.

Characteristics

The principal characteristics of the vessel are:

Length, overall	467'-2 15/16"
Length between perpendiculars	441'-0"
Breadth Molded, Amidships	56'-10 3/4"
Depth molded, to upper deck at side	37'-4"
Draft, load molded	26'-0"
Draft, full scantling, molded	26'-5 1/2"
Displacement, keel draft	13,825 Tons
Light Ship weight	4789.78 "
Deadweight, keel draft	9035.22 "
Register gross tonnage	7275.25

Characteristics (Cont'd)

Register net tonnage	4,518
Panama Canal gross tonnage	7,382.91
Panama Canal net tonnage	5,151.60
Suez Canal gross tonnage	7,424.64
Suez Canal net tonnage	5,667.34
Official number	241,879
Radio Call	KFVC
Bale Cubic	486,306 cu.ft.
Grain Cubic	545,985 " "
Fuel Oil	1,592 Tons
Diesel Oil	208 "
Lubricating Oil	-
Fresh Water	170 "
Ship's stores	12,446 cu.ft.
Fixed concrete ballast	1,002 Tons
Designed sea speed	15.4 knots
Shaft horsepower @ 101 RPM	6,000
Crew total	35
Passengers	10

Design

The following hull alterations were made to the standard Liberty design:

1. The bow section forward of frame 38 was removed and replaced by a new section 25'-0" longer and with finer lines. The additional length was utilized in hold No. 1.

2. The stern was modified to suit the increased power and speed by strengthening the shoe piece of the stern frame and trimming in way of the rudder trunk.

3. A new contra-type rudder and a new rudder stock were provided to suit the increased power and speed.

4. The steam steering gear was replaced with a Victory ship (Design VC2-S-AP2) electro-hydraulic unit with redesigned tiller to suit new rudder stock and rudder carrier.

5. Shaft alley was enlarged by raising top to suit higher shaft line and extending sides outboard. Surrounding structural members were corrected, and walkway and handrail relocated to suit modified shaft tunnel. Walkway plating was widened to suit new bearings and shaft flanges.

6. A deep tank with centerline swash bulkhead was provided in hold No. 1 between frames 4 through 12 and the full height of the lower hold for carriage of salt water ballast.

7. A new deep tank for salt water ballast or dry cargo is provided in hold No. 3 below the 18'-7" level, with centerline and transverse bulkheads. The existing end bulkheads were stiffened sufficiently to act as deep tank bulkheads. Two flush watertight hatch covers, one on each side of the centerline, were provided. Wood hold ceiling and sparring was removed in way of the new deep tank and replaced with metal battens, and tank top doubling plates in way of hatch openings. Four vertical ladders and manholes were provided for access to the deep tank. Existing piping in deep tank was modified or replaced where necessary, and new piping fitted to suit the purpose.

8. The section modulus of the midship section was increased above that required by the American Bureau of Shipping by about 15 per cent. This was accomplished by two riveted upper deck straps on each side of the vessel throughout the midship half length, one outboard of the hatch coaming brackets in way of the deckhouse passage, and one just inboard of the bulwark brackets. The deck under the inboard straps was slotted to form a crack arrestor. Intercostal bottom shell panel breakers were fitted fore and aft within the midship 3/5 length, four on each side, for a total of eight rows.

9. This ship's reefer space had been previously increased by the addition of two extra boxes recessed into the after bulkhead of hold No. 3 on the second deck.

10. The existing carbon dioxide fire extinguishing system in the machinery space was increased to a total flooding system. The steam smothering and steaming out system was extended to cover the spaces in the new bow section, and rearranged as necessary to suit the modifications in cargo hold spaces and deep tanks.

11. The machinery casing from the upper deck up to the house top was modified and extended. The existing engine room skylight was moved to a new location, and the original opening was plated over.

12. The Bridge Deck was extended aft three frame spaces, and the quarters on the Bridge, Boat and Main Decks were rearranged. In the After House the hospital and the passenger spaces have been rearranged.

The sizes and uses of the various holds and tanks are given in the capacity tables in the appendices.

Inclining Experiment

The ship was inclined on April 17, 1957, and a new stability booklet was issued.

Rudder

The rudder is a contra type, streamlined, of welded steel construction, and has a projected area of 145.3 square feet.

Steering Gear

The steering gear is the electric-hydraulic, double ram Rapson slide type with two similar power plants, each consisting of a variable displacement hydraulic pump driven through a flexible coupling by a continuously running electric motor. The variable displacement pumps are hydraulically connected to the rams which, in turn, actuate the rudder stock through sliding blocks and a double yoke tiller.

Steering is controlled by a telemotor transmitting unit in the Pilot House hydraulically connected through a double lead of piping to an after telemotor receiving unit in the steering gear room. Steering can also be controlled from the Flying Bridge by a mechanical steering stand with a slip coupling connection to the Pilot House telemotor, and from the after deck by direct mechanical control.

Either pump unit is capable of moving the rudder from hardover to hardover (70 degrees) in 30 seconds with the ship going ahead at a speed of 17 knots, and in 60 seconds with the ship going astern at a speed of 11 knots.

Emergency hand steering is provided in case of loss of electric power or failure of the regular controls. This is accomplished by means of a hand pump for generating the hydraulic pressure required to actuate the rams.

General

The original anchor windlass and equipment has been retained and moved to the new bow. The cargo gear, boats and boat handling equipment and the navigating equipment all remain as installed on the original ship. It has, however, all been overhauled and put in first class condition.

In addition, there has been installed a radar set and a complete portable radiotelegraph transmitter-receiver unit designed to furnish radiotelegraph communication facilities in an emergency.

As a further experiment in cargo handling equipment, two (2) Willie Baensch Hydraulic Cargo Winches have been ordered and will be installed subsequent to delivery of the ship. These winches will replace two steam winches at the aft end of No. 2 hatch.

SECTION III

MACHINERY INSTALLATION

Main Power Plant

The main propulsion machinery, manufactured by the General Motors Corporation, Cleveland Diesel Engine Division, consists of six (6) GS-34 Sigma-General Motors type free piston gas generators arranged in parallel, each of which discharges its gas to a common header, from which two gas lines lead to each of the two (2) gas turbines. The turbines, which are of the Alsthom design, are reversible and combine the ahead and astern stages on a common shaft, with six (6) ahead stages and two (2) astern stages. At full power the turbines operate at approximately 5500 RPM with a propeller speed of approximately 101 RPM. Full gas admission is provided to both ahead and astern elements.

The free piston gas generators are rated at approximately 1200 gas horsepower each, and each turbine has a normal rating of 3000 SHP. The turbines drive the single propeller through a double reduction gear.

The free piston gas generators operate on the two stroke diesel cycle, using Bunker "C" fuel oil for normal operations. When starting up they are operated on diesel oil for a short running period, approximately five minutes, when the change over to Bunker "C" fuel is made.

In addition to using diesel oil for starting the gas generators, it is also used for cooling the fuel injectors. The supply for this purpose is from the diesel oil fuel pumps with a branch off line to the injectors. The portion of the oil used for cooling is circulated around the fuel injectors and back to the day tank for cooling.

Prior to shutting down the plant a change back to diesel oil is made and operation is continued for a sufficient time to purge the Bunker "C" fuel oil from the system.

The cycle of operation is as follows: Air for both combustion and scavenging of the free piston gas generators is taken from the engine room which is supplied by four (4) forced draft fans. To start the gas generators, high pressure air from the starting flasks is admitted into the bounce cylinders, which drives the power pistons toward their inner dead point. During this stroke the air between the pistons is compressed, fuel is injected and fired. The high pressure starting air is supplied from eight (8) pressure tanks, having a combined capacity to provide eighteen (18) starts, that is, three (3) starts per gas generator.

When starting up, the gas mixture is at first by-passed to the atmosphere until the required number of gas generators are properly cycling. The gas mixture is then directed to the gas turbines where the two ahead and two astern control valves per turbine are set to apportion the gas flow to the ahead and astern stages so that no rotation results. At the same time, a masking disc which is fitted around the main turbine shaft between the ahead and astern elements deflects the spent gas out the exhaust outlet of the turbine. The disc is moved laterally along the shaft by the hydraulic control actuating system, the movement being to a position adjacent to the astern wheel, thus masking it in the case of ahead operation, with the opposite movement in the case of astern operation. Operation at any desired partial or full power ahead or astern is then obtained by changing the positions of these valves by movement of the main control wheel on the operating consoles. When it is required to operate the plant at reduced power and the number of gasifiers in operation is reduced, it is possible to maintain the pressure to the turbine by shutting off one of the control valves, thereby in effect decreasing the orifice opening size.

In the case of ahead operation, when the astern control valve is completely closed, a relay between the operating station and the gas generators comes into action and increases the quantity of fuel injected. Further operation of the control wheel in the ahead direction further increases the fuel supply with a consequent increase of gas pressure up to the full power of the turbines. The turbines exhaust to the atmosphere via independent lines led up through the smoke stack.

In reducing power or in going from ahead to astern, the preceding operation is reversed. Inasmuch as the free piston gas generators cannot operate below 30% of their rated normal gas delivery, it is necessary to shut down one or more gas generators if the ship is to be operated at less than full power for long periods of time. The gas generators remaining in operation will then operate at nearer their full power.

The operating control mechanism is duplicated on the Bridge, thus permitting full maneuverability of the ship from that area.

Main Power Plant (Cont'd)

The gas generator power cylinder walls are lubricated with a heavy duty lube oil, while the power pistons are oil cooled by means of the same lubricating oil used for the turbines and reduction gears. The power cylinders and compressor air delivery valve plates are jacketed and cooled with fresh water. The turbines and reduction gears have a combined pressure and gravity type lubricating oil system similar to the conventional steam turbine system.

The control of the propulsion plant is by means of a hydraulic system. This system consists of two rotary hydraulic pumps (one a stand-by), which takes suction from the turbine and reduction gear lube oil sump tank and delivers the oil to two branches, one a pilot system and the other a power system.

The pilot system, which operates in a range of 26 - 58 PSI, goes to the control consoles and from there to the turbines servo-motors and to the gas generators fuel rack control.

The power system branch, which operates at 110 PSI, goes to a hydro-pneumatic tank and from there to the power relay cylinders that operate the turbine control valves. A continuation of the line goes to the turbine control mechanism, which is acted on by the turbine lubricating oil pressure and the overspeed governor. The pressure oil is next led to the gas overpressure cylinder and then to each gas generator's over-stroke cylinder, finally reaching the fuel pumps on the gasifiers.

When any of the safety devices, such as the turbine overspeed governor, the turbine low lube oil pressure device, or the gas delivery overpressure device, is brought into operation there is an interruption of the power oil supply to the power relay cylinder of the fuel pump, thus cutting off the fuel supply to the gas generators and stopping the plant.

Likewise, an overstroke of the pistons in any one gas generator will cause the power oil pressure to fall and act on the power cylinder at the fuel pump, stopping the fuel supply to the fuel injector of that one gas generator.

Fuel Oil System

The fuel oil used in the free piston gasifiers is clean Bunker "C" fuel oil, however, for starting and stopping, diesel fuel oil is used.

Fuel Oil System (Cont'd)

For starting and stopping the plant, diesel oil is drawn from a 1200 gallon day tank, which in turn is replenished from the diesel oil storage tanks via a centrifuge with built-in pressure and discharge pumps. The fuel from the day tank passes through a duplex strainer to one of two diesel fuel oil service pumps, which supply a common header for the six gasifiers. This common header also supplies the diesel cooling oil for the fuel injectors, which portion of the oil recirculates to the day tank. It will thus be evident that one of the diesel service pumps will be in continuous operation while the plant is running. In addition, there is a hand priming pump in the line.

When the plant is in stable operation the system is changed over to Bunker "C" fuel oil. This oil is supplied from two fuel oil settling tanks, which in turn are replenished from their respective storage tanks. The temperature of the fuel oil in the settling tanks is controlled by means of steam heating coils. One of the two heavy fuel oil service pumps draws the oil from the settling tanks via a duplex strainer and delivers it to one of a pair of fuel oil heaters, where the temperature is raised to approximately 200° F, before passing to one of a pair of recirculating type centrifuges. From the centrifuge the fuel oil is pumped to a fuel oil service tank in which the level is controlled by a float operated valve. The temperature in the fuel oil service tank is maintained by steam coils.

A heavy fuel oil pump takes suction from the service tank through a strainer and delivers the oil through a secondary fuel oil heater which raises the temperature to that required at the gasifier. From there is passes to the manifolds which supply the gasifiers. A pressure relief valve at the end of the manifolds maintains a constant pressure in the system. The excess fuel by-passed by the pressure relief valves is returned to the fuel oil service tank.

Before shutting down the plant, the entire heavy fuel oil system is purged with diesel oil. This can be done by opening the valve from the 1200 gallon diesel oil day tank and closing the valve from the heavy fuel oil settling tank. A by-pass line is provided around the service tank so that the system can be purged of heavy fuel without the necessity of using all the fuel in the service tank.

The gasifiers can be individually controlled to operate on either diesel oil or heavy fuel by means of a 3-way valve which determines the type of fuel supplied to the gasifier attached fuel pump.

Air Starting System

The air for starting the gasifiers is supplied by five compressors. Four of these conpressors are electric motor driven, while the fifth, which is an emergency unit, is driven by a diesel engine. The motor driven compressors are rated at 600 PSI pressure and the diesel driven compressor is rated at 350 PSI pressure. The air supplied by the compressors is stored in eight pressure tanks. These tanks have a sufficient capacity to provide three (3) complete starts for each of the six (6) gasifiers, or a total of eighteen (18) starts.

The maximum air pressure required at each gasifier is 315 PSI. This pressure is required for the accumulator cylinder of the fuel pump, and is adjusted by means of a pressure reducing valve attached to the engine.

The pressure required for starting a gasifier is 240 PSI. This air is admitted to the gasifier attached starting air reservoir by means of the starting handwheel of the gasifier. When the air pressure in the attached starting air reservoir reaches 240 PSI, the valve is closed and a metered quantity of high pressure air is admitted to the bounce chambers to start the engine. The gasifier attached starting air reservoir is not again replenished until it is necessary to start the engine again. During engine operation, the 315 PSI required for the fuel pump is the only air pressure required for the gasifiers.

A 600/300 PSI air reducing valve supplies air to an auxiliary tank for the diesel generator sets. The emergency diesel driven compressor is used for starting the diesel generators on a dead ship when shoreside power is not available. Once the generator sets are operating, the electric motor driven compressors can supply the necessary air.

The four electric air compressor controls are so arranged that as the pressure in the tanks drops below normal, one air compressor will start automatically. If the pressure continues to drop, the other compressors will start successively. Once the compressors have started they are electrically locked in so that they will not shut off until the tank pressures have reached 600 PSI. A manual selector switch is provided to change the starting sequences of the compressors, thereby equalizing the length of operation time of each compressor.

Air for the hydraulic actuator tank and for the piston cooling oil temperature regulators is also taken from the 600 PSI system. The air to the hydraulic system is supplied through a 600/90 PSI regulator. The 90 PSI air is further reduced to 20 PSI through individual regulators for the hydraulic actuator tank shutoff valve in the hydraulic system and for the lube oil temperature control valves in the piston cooling oil system.

Air Starting System (Cont'd)

The ship's service air receiver is also supplied from the 600 PSI compressors via a reducing valve.

Reduction Gears

The double reduction gears, manufactured by the Western Gear Works, Lynnwood, California, are designed for a rated power of 6000 SHP at 101 RPM of the propeller, with 5500 RPM at the turbines. The gear reductions are 8.795 to 1 first stage and 6.19 to 1 for the second stage.

The gear is a double reduction, double helical, separate helix, locked train type. The gear elements consist of two high speed pinions, four high speed gears, four low speed pinions and one low speed bull gear.

Each high speed pinion is driven from a gas turbine through a flexible coupling, and meshes with two high speed gears. Each high speed gear drives a low speed pinion through a flexible, electric quill shaft and dental couplings. Each low speed pinion meshes with the bull gear.

A motor driven turning gear is located on the port side of the gear unit, and will turn the shafting, gearing and turbines continuously in either direction at a bull gear speed of one revolution every ten minutes.

The propeller thrust bearing is the pivoted segmental type arranged in a housing at the forward end of the reduction gear housing. Provision is made for the installation of a thrust meter.

Thrust bearings are also provided to position the high speed gear elements.

Propeller

The propeller is right-hand viewed from the stern. It is manganese bronze, four bladed, 17'-6" in diameter with a pitch of 17'-1". The propellers of the S.S. BENJAMIN CHEW, M.V. THOMAS NELSON and the G.T.V. WILLIAM PATTERSON are interchangeable.

Shafting

The line shafting consists of six (6) sections 15 1/4" in diameter, each 23'-9" long. There are eight (8) line shaft bearings in way of which the shafts are 15½" in diameter. The tail shaft is 17'-11" long with a diameter of 15 1/4" in way of the coupling flange, and 19 5/16" and 19 1/4" diameter over the bronze sleeve.

The stern tube, which is cast steel, is 10'-10" in length and is welded into the stern frame and into the after peak bulkhead. In way of the stern frame the O.D. is 26 3/4", which is then stepped up to 28 3/4" O.D., and in way of the bulkhead it is 31½" O.D. It is bored to 23 1/8" in way of the after bushing and to 23 1/4" for the forward bushing. It is fitted with two bronze bushings, one 6'-1/2" long and one 2'-2½" long, each of which is fitted with lignum vitae bearing staves for a total length of 8'-8 3/4".

Lubricating Oil System

The lube oil system, which is a combined pressure gravity system, consists of one 2500 gallon storage tank; one 1800 gallon settling tank; one 1200 gallon gravity tank; one sump or drain tank; one 50 gallon sludge tank; two oil coolers; one manually operated stripping pump; one purifier with heater; two motor driven service pumps; one steam driven emergency pump, with all necessary strainers, gages, thermometers, indicators and valves. One electric motor driven lube oil pump, the steam driven lube oil pump, and one lube oil cooler are standby equipment.

The cycle of operation is as follows: Oil is drawn from the sump tank through a magnetic duplex strainer by one of the electric motor driven lube oil pumps. The oil then passes through a simplex strainer to a lube oil cooler and from there to the inlet connections to the reduction gears and the turbine bearings. In order to take care of different viscosity requirements of the turbine and the gears a by-pass line is provided around the coolers, which connects into the header for the turbines. The required viscosity of the oil to the turbines is therefore controlled by the proper mixing of the oil from the coolers with the hot oil from the by-pass line. The control is adjusted by setting two throttle valves, one in each line.

Orifice plates are installed at the inlet to the turbines and gears to maintain the proper pressure and flows to these units.

Lubricating Oil System (Cont'd)

There is a lube oil heater and purifier which can be operated either continuously, taking suction direct from the sump, or on the batch system, taking suction from the settling tank. In either case the purified oil is discharged into the gravity tank. The gasifier piston cooling oil and the oil from the diesel generator sumps also are put through the purifier.

A hand stripping pump is provided which takes suction from the sump tank and can discharge to either the settling tank, the gravity tank or the sludge tank.

Gasifier Piston Lubricating Oil System

The same oil used for lubricating the turbines and gears is used for piston cooling, and is supplied from the 2500 gallon lube oil storage tank.

The system consists of three (3) electric motor driven gear pumps, one being used as a standby; two (2) piston cooling oil coolers and two piston cooling lube oil sump tanks. This equipment is divided into two separate systems, each taking care of three (3) gasifiers. They can, however, be cross-connected for emergency operations.

In operation the oil is drawn from the sump tanks, through suction strainers into the pumps, and then through simplex strainers to automatic lube oil temperature regulators. The regulators direct the oil around or through the lube oil coolers (depending on the temperature) and then to a manifold from which each gasifier is supplied. The oil then drains back to the sump by gravity, the flow rate being approximately 45 G.P.M. A small portion of supply oil enters the filter at the rear of each gasifier and lubricates the gasifier fuel pump actuating mechanism. This oil is periodically purified by the same centrifuge used for the oil for the turbines and gears.

In addition to the temperature regulators which control the flow to the coolers, there is a thermostatic pilot control element in each gasifier drain line to the sump tank. The gasifier control elements are installed in series so that the maximum oil temperature of any one gasifier limits the temperature for the three (3) in the system. If there is a failure in the control air, the regulators fail in an open position allowing full flow of oil through the oil coolers.

Gasifier Cylinder Lubricating Oil System

This is an entirely independent system using a heavy duty oil supplied by gravity from a 3000 gallon supply tank.

The oil flows from the tank through a strainer to a forced feed lubricator mounted on each gasifier. The lubricator is driven by linkage from the fuel pump drive.

The forced feed lubricators distribute the oil, under pressure, to the various reciprocating parts of the gasifier. There is no recirculation of this oil and it is eventually burned.

Gasifier Cylinder Cooling Water System

Fresh water cooling is provided for the power cylinder assembly; the scavenge and exhaust cylinders; the air delivery valve plates; the air starting valve housing; the portion of the exhaust side synchronizing rod exposed to radiation from the exhaust gas collector ring; the cylinder for the positioning piston; and the body of the exhaust reservoir attached gas valve.

The cooling water is circulated by two (2) motor driven vertical pumps (one a standby unit) of 600 G.P.M. capacity. There are two (2) fresh water coolers, sea water being the cooling medium. There is one (1) fresh water automatic temperature regulator.

Condensing Apparatus

The ship's existing auxiliary condenser, the combined circulating and wet air pump and allied piping, has been retained. The condenser is used to receive the exhaust steam from the retained steam driven auxiliaries.

Generators

There are two (2) diesel driven electric generators.

The engines are Baldwin Model VO six (6) cylinder diesel, bore 12.75", stroke 15.5", rated at 450 BHP at 400 RPM. The engines are arranged for air starting, the starting air being supplied from the main plant air cylinders.

Generators (Cont'd)

The generators are Crocker Wheeler 250 KW, 240/120 volts D.C. at 400 RPM.

One diesel generator set will carry the maximum sea load of the vessel. They are, however, arranged to operate successfully in parallel.

Main Switchboard

The main generator and distribution switchboard is arranged for the control of the two 250 KW, 3 wire, 120/240 volt D.C. ship's service generators and for the distribution of power, lighting and I.C. circuits.

The lighting system is built for 115 volt operation. For emergency lighting there are provided twelve (12) portable watertight hand lanterns installed on bulkheads at approved locations. The lanterns are battery powered and relay operated from the ship's lighting system.

There is installed on the after end of the deckhouse near the centerline, a watertight shore connection box to provide means of supplying 120/240 volt D.C. shore power to the main switchboard.

Boilers

The ship is fitted with two (2) package type, semi-automatic Combustion Engineering type V2M boilers. They are designed for operation on purified Bunker "C" fuel oil, however, provision is made for operation on diesel fuel oil, which is necessary for cold ship starting. In starting up the initial ignition is carried out manually using a lighted torch. From this point on the operation is entirely automatic.

The boilers are two drum bent tube type with water wall tubes in the floor, sidewell and roof, and have the following characteristics:

Rating normal	6500 Lb./Hr.
" maximum	7500 Lb./Hr.
Furnace volume	115 cu. ft.

Boilers (Cont'd)

Heating surface boiler	895 sq. ft.
" " water wall	57 " "
Pressure Operating	230 PSIG
Steam temperature (Normal)	399° F
Feedwater "	120° F
Air to burners	100° F
Drum safety valve settings	
One at	245 PSIG
" "	250 PSIG

The burner is Todd Model "DVC-75" semi-automatic type.

Forced Draft and Ventilation Blowers

All of the original blowers have been removed from the ship, and have been replaced by four (4) 24,000 CFM 2" static pressure blowers.

The blowers, manufactured by L. J. Wing Manufacturing Company, are Vane Axial Flow Fans 10/5 H.P., 1150/850 R.P.M. They are driven by 230 volt D.C. motors, manufactured by the Electro Dynamic Company.

Two of the blowers have the primary function of supplying combustion air to the six (6) gasifiers. Their discharge ducts are so arranged that each blower normally supplies only three (3) gasifiers, though they are arranged to be cross connected. Branch ducts from each of the blower delivery lines are directed so as to discharge their air onto plenum chambers which are directly connected to the air inlets on the gasifiers.

To minimize air pulsations due to the rapid cycling of the gasifiers, air is supplied to them in pairs. This is accomplished by fitting two (2) plenum chambers to each pair of gasifiers, one plenum chamber supplying the forward intakes on each gasifier, with the other supplying the after intakes. The gasifiers in each pair are so controlled as to prevent their cycling in phase.

The other two (2) blowers distribute air over the entire machinery space and assist in maintaining the static pressure when the gasifiers are operating.

There is also one (1) exhaust fan which removes the vapors from around the fuel oil purifier. It is 2 H.P., 1750 R.P.M., 230 volt D.C. constant speed continuous duty, and is manufactured by the U. S. Air Conditioning Corporation, Minneapolis, Minnesota, with the motor supplied by the Electro Dynamic Company.

Feed Water System

The original feed pumps, feed injector, feed and filter tank, feed heater, grease extractor and associated piping have been removed. A new 300 gallon feed and filter tank has been installed, from which the feed pumps of the package boilers take their suction. The feed pumps also take suction from the reserve feed tanks.

The existing contaminated drains inspection tank, with vents, overflows and gages, has been retained but relocated. A drain cooler has been provided to receive the heating drain returns from all oil tanks and oil heaters, and discharges to the inspection tank.

Evaporator Plant

The existing salt water evaporator, distiller, test tank and connecting piping has been retained without change; the old pumping equipment has been removed and a new evaporator feed line has been provided from the existing salt water service pump discharge to the distiller, complete with all necessary valves, fittings, etc.

The existing salinity indicator equipment has been retained.

Water Systems

The existing potable and wash water systems are retained except where relocation has been required by structural changes. Additional hot and cold fresh water systems have been provided for all new and relocated showers, sinks and lavatories.

The gas generators have been provided with a fresh water cooling system which is described under the generators.

Refrigeration System

The existing refrigerating system has been retained. This ship differs from a standard Liberty ship by reason of the fact that two (2) additional boxes had already been installed in No. 3 Hold just forward of Bulkhead No. 88. This bulkhead has been recessed to include the boxes. One additional reefer compressor had already been installed to handle the additional load.

Ventilation and Heating

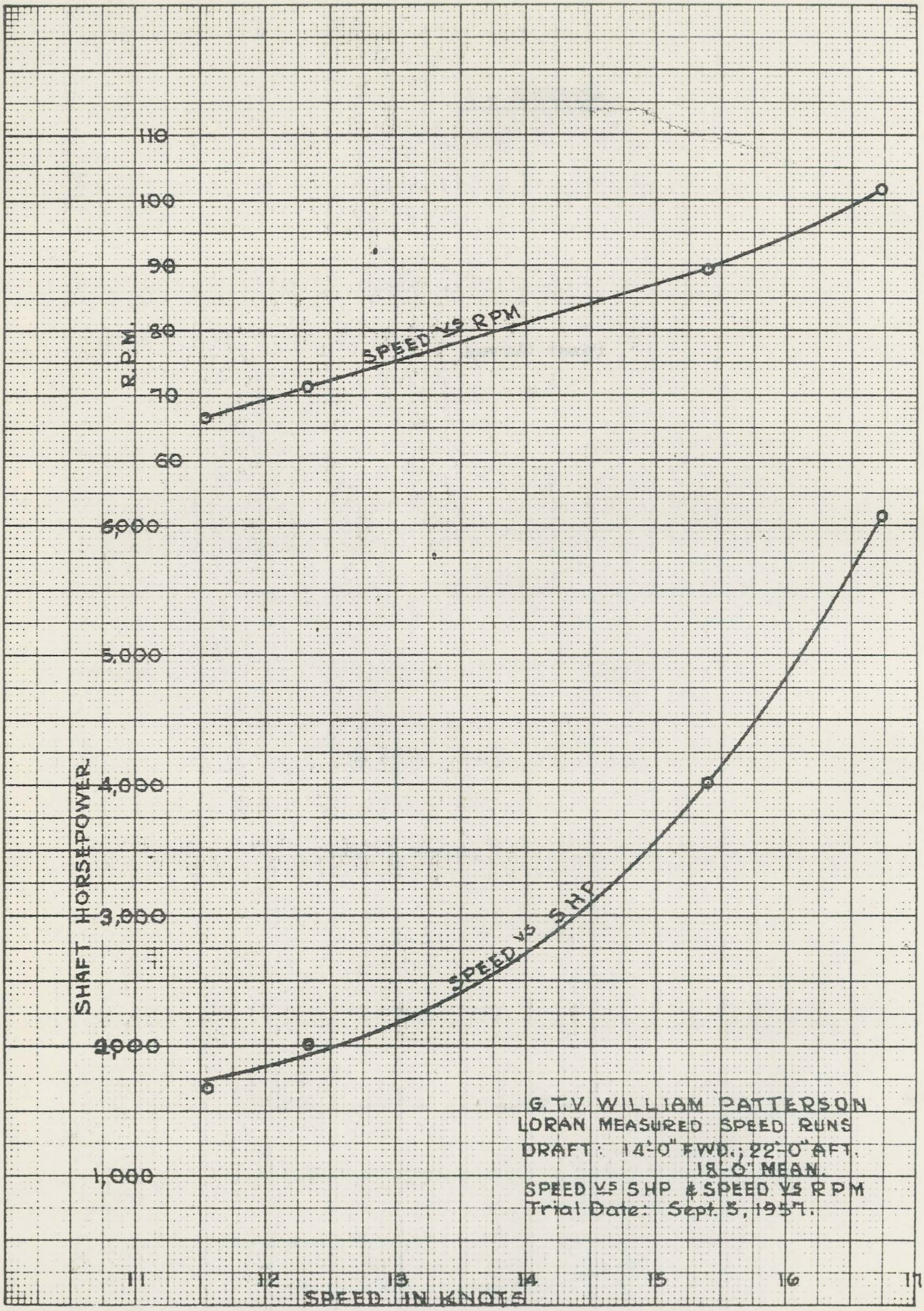
The ventilation and heating has been retained as originally installed, with the addition of similar treatment for the newly installed quarters.

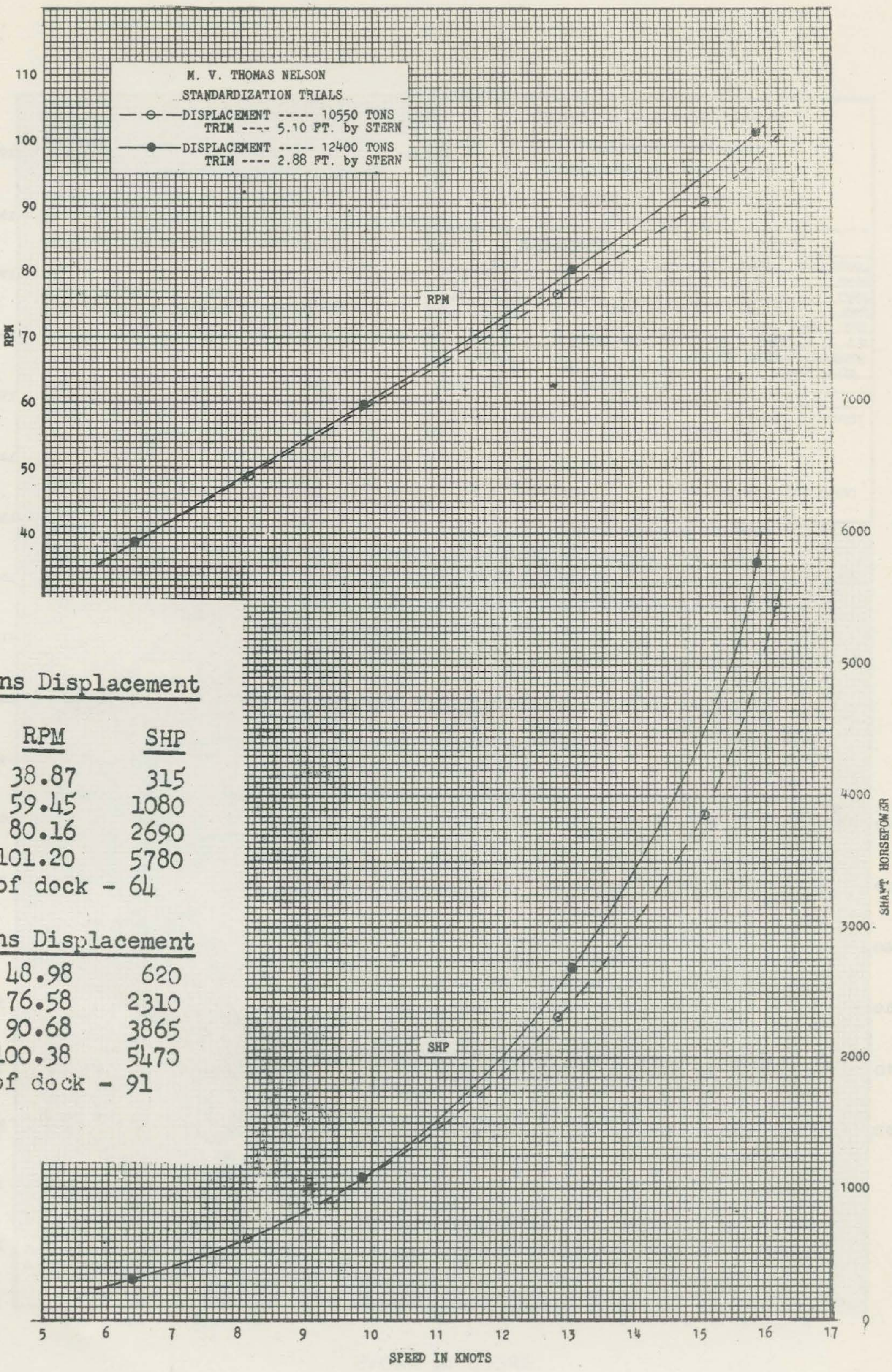
A new propeller type fan has been provided for exhaust from the officers pantry, which discharges through the side of the house. The galley system has been revised, as required, by the installation of the new engine room stack.

Natural ventilation by means of cowl ventilators is provided for the cargo holds, the bosn's stores and the deep tank in No. 3 hold.

APPENDIX - A

Power Curves


110
100
90
80
70
60
R.P.M.
SPEED V.S RPM
6,000
5,000
4,000
3,000
2,000
1,000
SHAFT HORSEPOWER
SPEED V.S S.H.P.
G.T.V. WILLIAM PATTERSON
LORAN MEASURED SPEED RUNS
DRAFT: 14'-0" FWD.; 22'-0" AFT.
18'-0" MEAN.
SPEED V.S SHP & SPEED V.S RPM
Trial Date: Sept. 5, 1957.
11
12
13
14
15
16
17
SPEED IN KNOTS



12,400 Tons Displacement

Knots	RPM	SHP
6.39	38.87	315
9.86	59.45	1080
13.04	80.16	2690
15.86	101.20	5780

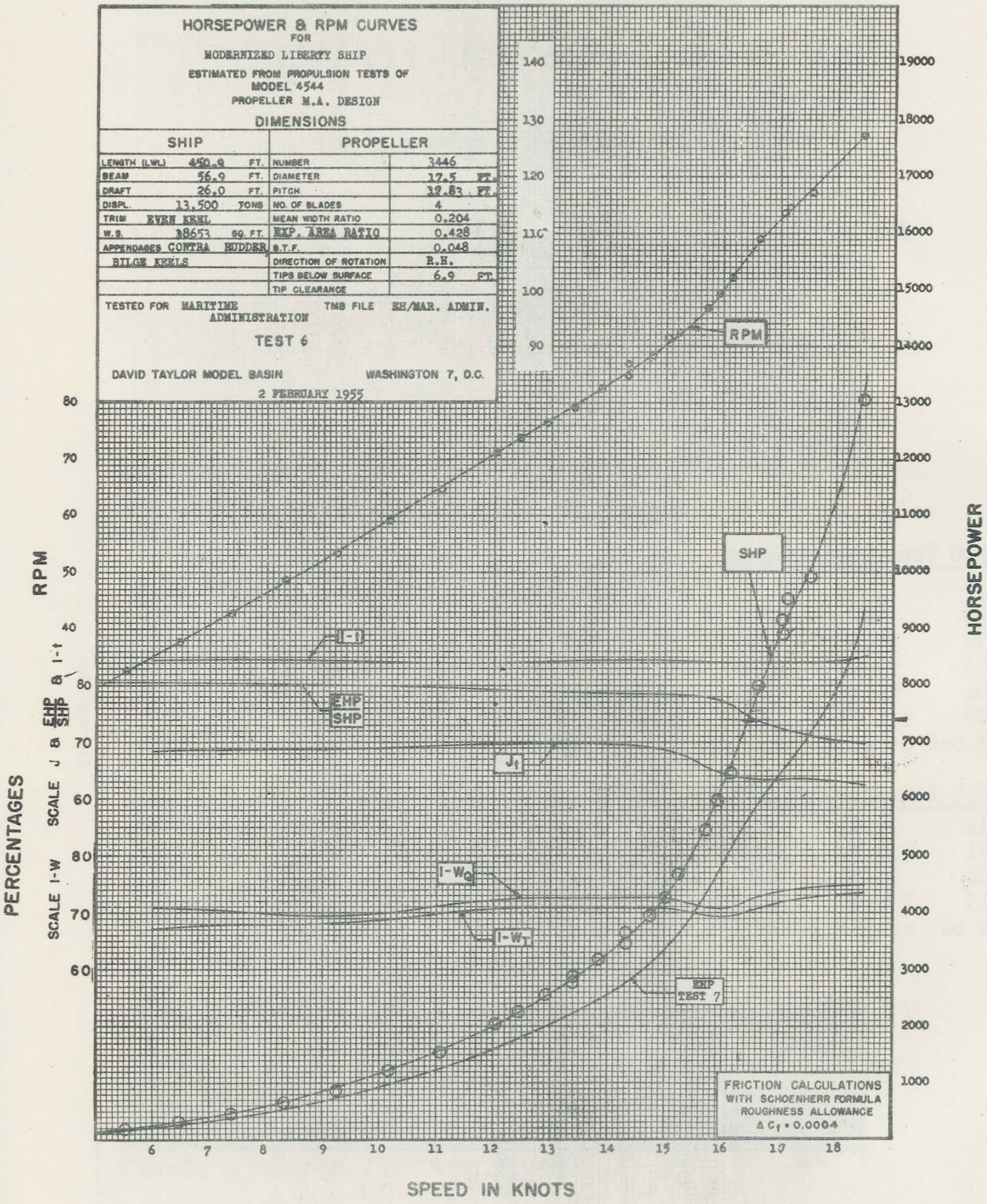
Days out of dock - 64

10,550 Tons Displacement

Knots	RPM	SHP
8.11	48.98	620
12.81	76.58	2310
15.06	90.68	3865
16.15	100.38	5470

Days out of dock - 91

Standardization curves for M.V. THOMAS NELSON. Standardization trials run by David Taylor Model Basin at the W. Looe measured mile trial course off Plymouth, England.
Standardization curves apply also to G.T.V. WILLIAM PATTERSON.



HORSEPOWER & RPM CURVES
FOR
MODERNIZED LIBERTY SHIP
ESTIMATED FROM PROPULSION TESTS OF
MODEL 4544
PROPELLER M.A. DESIGN

DIMENSIONS

SHIP		PROPELLER	
LENGTH (LWL)	450.9 FT.	NUMBER	3446
BEAM	56.9 FT.	DIAMETER	17.5 FT.
DRAFT	26.0 FT.	PITCH	19.83 FT.
DISPL.	13,500 TONS	NO. OF BLADES	4
TRIM	EVEN KEEL	MEAN WIDTH RATIO	0.204
W.S.	38653 SQ. FT.	EXP. AREA RATIO	0.428
APPENDAGES	CONTRA RUDDER	B.T.F.	0.048
BILGE KEELS		DIRECTION OF ROTATION	R.H.
		TIPS BELOW SURFACE	6.9 FT.
		TIP CLEARANCE	

TESTED FOR MARITIME ADMINISTRATION
TMB FILE EH/MAR. ADMIN.

TEST 6

DAVID TAYLOR MODEL BASIN
WASHINGTON 7, D.C.

2 FEBRUARY 1955

APPENDIX - B

Summary of Speed Trials

SPEED MEASUREMENT TRIAL CONDITIONS

Date of Trial	September 5, 1957
Draft forward	14'-0"
Draft aft	22'-0"
Mean Draft	18'-0"
Displacement	8,925 Tons
Time out of dry dock	133 days
Depth of water	Over 100 fathoms

Location of Trials - A course 036° N and 216° S between the Loran Stations on Nantucket Island and Cape Hatteras.

Distances were measured by Loran instruments installed and operated by the United States Coast Guard. Loran data was obtained by the simultaneous graphic recording of time difference readings on two loran rates. The equipments used were automatic-tracking type RD-131-Mod 1 Loran Receiver Indicators.

Speed determinations, by use of Loran instruments, were made during the regular fuel economy trials. Two runs were made in opposite directions at each power except for the 1670 SHP run, which was made only in the southerly direction. The results reported are uncorrected for wind, sea or other influencing factors. The averages are unweighted arithmetical averages.

Shaft horsepower, RPM and thrust were measured with the trial instruments described in Appendix H.

SPEED MEASUREMENT RUNS

Run No.	Course	SHP	RPM	Elapsed Time Min.	Loran Reading 1 H 4 Micro-Seconds	Distance Nautical Miles	Speed Knots	Thrust Lbs.	Thrust Horse-power
1	036°	6012	101.9	45	2617 2771	12.45	16.6	100,900	5,205
2	216°	6106	101.6	55	2773.5 2585	15.4	16.8	103,900	5,295
3	036°	6099	102.0	210	2585 3278	56.3	16.0	103,390	5,051
4	216°	6106	102.2	30	2752.5 2770	8.75	17.5	102,900	5,259
Average		6081	101.9				16.73		
5	216°	3969	89.55	55	3112 2932.5	14.7	16.0	79,600	3,910
6	036°	4057	89.8	60	2941.5 3124	14.8	14.8	80,700	3,667
Average		4013	89.68				15.4		
7	216°	1670	66.9	60	3157 3012.5	11.8	11.8	43,500	1,576
*Average		1670	66.9				11.55		
8	216°	2006	71.3	55	2952 2810.5	11.6	12.65	49,800	1,934
9	036°	2004	71.1	60	2813 2962	12.0	12.0	50,500	1,861
Average		2005	71.2				12.33		

* Run made in one direction only. Average speed shown is corrected from extrapolating the difference in north and south speeds for runs 5, 6 and 8, 9.

APPENDIX - C

Summary of Machinery Trial Data - Economy Runs

During the astern trial the temperatures for the port turbine were considerably higher than those for the starboard turbine. At the conclusion of the trials, General Motors Corporation investigated the condition in an attempt to improve astern operation. It was discovered that the non-return valves of gasifiers Nos. 1, 2 and 3 had been improperly connected. This resulted in the valves being in a partially closed condition throughout the trials.

Trial results as reported herein are as actually measured. No attempt has been made to correct for the non-return valves on the gasifiers 1, 2 and 3 being partly closed. In fact, sufficient data is not available to make such an evaluation. There is no doubt, however, that the astern SHP, as well as the ahead SHP and all the fuel rates would have been improved had all the non-return valves been completely open.

The installation of the valves was corrected prior to delivery of the ship.

ECONOMY RUNS - BUNKER "C" FUEL

	6,000 SHP STAND-BY AUXILARIES	6,000 SHP MAX. POWER	4,000 SHP	2,000 SHP
GENERAL				
Date	9-4-57	9-5-57	9-5-57	9-5-57
Trial SHP	5668	6090	4009	2005
Trial RPM	99.3	101.9	89.6	71.2
Duration, Hrs.	2	6.5	2	2
No. Gasifiers in use	6	6	5	4
Gas Valves open - Port turbine	2	2	2	1
" " " - Stbd. turbine	2	2	1	1
FUEL CONSUMPTION				
Gasifiers Supply				
*Meter 2023417, Gal.	1892.7	6107.0	2046.0	2156.0
**Correction factor	.9905	.9915	.9910	.9910
Correct gallons	1874.7	6055.0	2027.6	2136.6
*Meter 2023419, Gal.	1896.5	6129.5	2052.0	2151.0
**Correction factor	.9885	.9898	.9890	.9895
Correct gallons	1874.7	6067.0	2029.4	2128.4
Average correct gallons	1874.7	6061.0	2028.5	2132.5
Temp. thru meters, °F	184	183	186	188
Wt. oil, lbs./gal.	7.7735	7.7765	7.7675	7.7625
Total oil supplied, lbs./hr.	7286.5	7251.3	7878.2	8276.8
Injector Return				
*Meter 2023416, Gal.	887.0	2803.0	1243.0	1678.0
**Correction factor	1.001	1.002	1.002	1.0035
Correct gallons	887.9	2808.6	1245.5	1683.9
*Meter 2023418, Gal.	885.0	2796.0	1241.0	1677.0
**Correction factor	.998	.9985	1.000	1.002
Correct gallons	883.2	2791.8	1241.0	1680.4
Average correct gallons	885.6	2800.2	1243.3	1682.2
Temp. thru meters, °F	192	191	195	195
Wt. oil, lbs./gal.	7.750	7.7535	7.7425	7.7425
F.O. injector return, lbs./hr.	3431.7	3340.2	4813.2	6512.2

	6,000 SHP STAND-BY AUXILARIES	6,000 SHP MAX. POWER	4,000 SHP	2,000 SHP
F.O. Header Return				
Meter 1252735, Gal.	307.3	891.5	245.8	236.3
**Correction factor	.988	.988	.988	.988
Correct gallons	303.6	880.8	242.8	233.4
Temp. thru meter, °F	188	185	184	184
Wt. oil, lbs./gal.	7.7625	7.771	7.7735	7.7735
F.O. Header return, lbs./hr.	1178.3	1053.0	943.7	907.2
Gasifier Fuel Consumption				
Total F.O. supplied, lbs./hr.	7286.5	7251.3	7878.2	8276.8
Total F.O. returned, lbs./hr.	4,610.0	4393.2	5756.9	7419.4
F.O. consumed (as burned) (18,335 BTU/lb.), lbs./hr.	2676.5	2858.1	2121.3	857.4
F.O. consumed (corrected to 18,500 BTU/lb.), lbs./hr.	2652.6	2832.7	2102.4	849.8
Fuel rate - lbs./SHP-Hr.	.4680	.4651	.5244	.4238
Generators (Diesel)				
Outboard Generator K.W.	89.9	178.2	180.8	183.5
Inboard Generator K.W.	91.5	-	-	-
Diesel Oil Supply				
*Meter 2023415, Gal.	38.6	100.7	30.8	30.8
**Correction factor	1.015	1.015	1.015	1.015
Correct gallons	39.2	102.2	31.3	31.3
*Meter 2023414, Gal.	33.5	84.2	25.8	25.3
**Correction factor	1.075	1.075	1.075	1.075
Correct gallons	36.0	90.5	27.7	27.2
Average correct gallons	36.7	96.4	29.5	29.3
Temp. thru meters, °F	119	123	124	117
Wt. D.O., lbs./gal.	6.813	6.800	6.798	6.820
D.O. consumed (as burned 19,605 BTU/lb.) lbs./hr.	128.1	100.6	100.6	100.3
Oil consumed (corrected to 18,500 BTU/lb., lbs./hr.	135.8	106.6	106.6	106.3
Boilers Supply				
*Meter 2023421, gal.	255.5	788.5	233.3	253.3
**Correction factor	.992	.992	.992	.992
Correct gallons	253.5	782.2	231.4	251.2
*Meter 2023419, gal.	255.0	787.5	233.3	253.0

Boilers (Cont'd)
Supply (Cont'd)

**Correction factor	.9855	.9860	.9855	.9860
Correct gallons	251.3	776.5	229.9	249.5
Average correct gallons	252.4	779.4	230.6	250.4
Temp. thru meters, °F	104	105	116	114
Wt. oil, lbs./gal.	8.003	8.000	7.968	7.975
F.O. supplied, lbs./hr.	1010.0	959.3	918.7	998.5

Return

*Meter 1252737, gal.	117.8	667.0	177.5	205.0
**Correction factor	.916	.933	.930	.932
Correct gallons	107.9	622.3	165.0	191.1
*Meter 1060330, gal.	138.5	593.5	160.3	184.0
**Correction factor	1.036	1.024	1.031	1.0295
Correct gallons	143.5	607.7	165.2	189.4
Average correct gal.	125.7	615.0	165.2	190.3
Temp. thru meters, °F	128	119	126	125
Wt. oil, lbs./gal.	7.935	7.961	7.940	7.943
F.O. returned, lbs./hr.	498.7	753.2	655.9	755.8
F.O. consumed (as burned 18,335 BTU/lb.), lbs./hr.	511.3	206.1	262.8	242.7
F.O. consumed (corrected to 18,500 BTU/lb.), lbs./hr.	506.8	204.3	260.5	240.5

ALL PURPOSE

Total fuel consumption (18,500 BTU/lb.) lbs./hr.	3295.2	3143.6	2469.5	1196.6
All purpose fuel rate - (18,500 BTU/lb.) lbs./SHP-Hr.	.5814	.5162	.6160	.5968

* One of two meters connected in series. Readings of the two meters corrected by the meter factor and averaged is considered as the correct flow measurement.

** From pre-trial calibration

G.T.V. WILLIAM PATTERSON
Official Trials

GENERAL DATA

	6,000 SHP STAND-BY AUXILARIES	Bunker "C" Economy Runs		
		6,000 SHP MAX. POWER	4,000 SHP	2,000 SHP
Time	1330-1530	0530-1200	1225-1425	1705-1905
Date	9-4-57	9-5-57	9-5-57	9-5-57
Eng. exh. pot temp. °F, #1 Gasifier	898.0	916.1	484.0*	230.0*
#2 Gasifier	810.0	858.9	793.0	698.0
#3 Gasifier	840.0	863.7	825.0	721.0
#4 Gasifier	883.0	917.1	848.0	586.0*
#5 Gasifier	823.0	866.4	793.0	696.0
#6 Gasifier	857.0	874.3	830.0	719.0
*Gasifier not in operation				
Scavenging Air temp. °F, #1 Gasifier	424.0	426.7	211.0*	90.0*
#2 Gasifier	417.0	421.6	394.0	344.0
#3 Gasifier	418.0	420.0	401.0	357.0
#4 Gasifier	428.0	423.9	402.0	312.0*
#5 Gasifier	422.0	424.6	400.6	355.0
#6 Gasifier	438.0	440.7	425.4	373.0
Gas in outboard inlet °F Port Turbine	886.0	915.4	828.6	654.0
Gas in inboard inlet °F " "	872.0	901.1	840.0	730.0
Casing ahead, °F " "	872.0	902.1	819.2	675.0
Casing astern, °F " "	706.0	759.9	702.0	563.0
Casing exhaust, °F " "	552.0	499.3	468.0	430.0
Forward bearing, °F " "	143.0	144.5	141.0	137.0
After bearing, °F " "	136.0	134.4	131.8	132.0
Gas in outboard inlet, °F Stbd. Turbine	843.0	872.9	723.0	618.0
" " inboard inlet, °F " "	862.0	894.9	824.4	712.0
Casing Ahead, °F " "	838.0	868.6	754.0	650.0
Casing Astern, °F " "	669.0	719.6	696.6	587.0
Casing Exhaust, °F " "	531.0	552.6	571.0	532.0
Forward bearing, °F " "	140.0	137.1	144.0	135.0
After bearing, °F " "	133.0	128.9	132.8	127.0
Port piston cooling oil to gasifier, psig	53.8	58.1	51.3	48.2
Stbd. " " " " ", psig	57.3	57.1	55.4	46.8
Gas manifold, psig	38.2	40.1	36.6	30.0
Gear & turb. L.O. press., psig	18.5	18.5	18.5	18.5
Heavy fuel oil feed, psig	43.4	43.6	42.4	41.0
Light fuel oil feed, psig	43.5	42.9	43.0	42.0
Salt water, psig	22.3	22.5	23.3	23.6
Fresh water, psig	38.3	38.5	36.9	34.8

*Gasifier not in operation

	Bunker "C" Economy Runs			
	6,000 SHP STAND-BY AUXILARIES	6,000 SHP MAX. POWER	4,000 SHP	2,000 SHP
Starting air pressure, psig	570.0	567.9	577.0	573.0
Hydraulic oil pressure, psig	108.8	110.4	110.0	108.4
Turb. inlet valve position #1 valve Stbd. Inbd.	Open	Open	Open	Open
Turb. inlet valve position #2 valve Port outboard	Open	Open	Open	Closed
Turb. inlet valve position #3 valve Stbd. outboard	Open	Open	Closed	Closed
Turb. inlet valve position #4 valve Port inboard	Open	Open	Open	Open
Ambient air temp., °F	98.3	97.2	96.5	93.1
Cycles per minute - #1 Gasifier	569.6	572.4	Off	Off
#2 Gasifier	579.6	569.3	550.2	615.6
#3 Gasifier	569.6	574.9	555.2	530.0
#4 Gasifier	559.2	564.6	549.6	To atmos.
#5 Gasifier	574.4	600.9	546.8	508.0
#6 Gasifier	574.8	630.5	562.4	514.0
Gasifier #3 - Serial No. 94006				
Engine I.D.P. MM	28.8	27.5	30.0	35.0
Engine O.D.P. MM	489.0	488.6	470.0	440.0
Stab. setting MM	7.0	10.0	10.0	17.0
Fuel Rack Setting MM	35.0	36.0	34.0	27.0
Air to F.O. Accumul. Tank, psig	373.0	365.7	360.0	315.0
Piston cooling oil in Exh. end., °F	114.4	108.4	113.8	118.4
" " " " Scav. end., °F	117.6	110.0	115.0	118.2
" " " at gasifier, psig	45.6	26.2	28.0	29.6
" " " out Exh. end, °F	144.6	141.1	143.2	139.6
" " " " Scav. end, °F	138.4	133.8	135.4	132.0
Fresh water in, °F	137.2	135.0	135.6	134.2
" " out, °F	156.0	156.0	154.0	148.6
Gasifier #4 - Serial No. 94011				
Engine I.D.P. MM	20.8	21.1	22.6	By-passed
Engine O.D.P. MM	489.0	487.9	461.0	to
Stab. setting MM	14.0	12.5	12.5	Atmos.
Fuel Rack setting MM	34.0	36.0	32.6	"
Air to F.O. Accumul. tank, psig	350.0	350.0	350.0	"
Piston cooling oil in Exh. end, °F	108.0	102.4	102.0	"
" " " " Scav. end, °F	109.2	109.7	109.4	"
" " " at gasifier, psig	27.0	31.6	28.0	"
" " " out exh. end, °F	141.0	141.6	142.2	"
" " " " Scav. end, °F	135.2	134.1	130.4	"
Fresh water in, °F	137.6	135.0	135.0	
" " out, °F	153.6	154.0	151.4	"

	Bunker "C" Economy Runs			
	6,000 SHP STAND-BY AUXILARIES	6,000 SHP MAX. POWER	4,000 SHP	2,000 SHP
Gasifier #1 - Serial No. 94009				
Engine I.D.P. MM	25.0	30.0	30	Not
Engine O.D.P. MM	480.0	456.4	440	in
Stab. setting MM	8.0	9.4	4.0	Operation
Fuel Rack setting MM	33.8	33.0	18.0	"
Air to F.O. Accumul. Tank, psig	350.0	350.4	350.0	"
Piston cooling oil in exh. end, °F	114.0	108.4	114.0	"
" " " " scav. end, °F	113.6	107.8	114.0	"
" " " at gasifier, psig	28.8	28.6	32.0	"
" " " out exh. end, °F	142.6	144.9	132.0	"
" " " out scav. " °F	141.6	134.0	128.0	"
Fresh water in, °F	136.0	135.7	136.0	"
Fresh water out, °F	155.8	155.4	144.0	"
Gasifier #2 - Serial No. 94010				
Engine I.D.P. MM	25.0	25.0	30.0	33.0
Engine O.D.P. MM	478.0	489.6	470.0	440.0
Stab. setting MM	13.4	14.0	14.0	19.2
Fuel Rack setting MM	33.8	36.8	32.0	25.4
Air to F.O. Accumul. Tank, psig	348.0	342.5	346.0	342.0
Piston cooling oil in exh. end, °F	113.0	106.7	113.0	116.0
" " " " scav. " , °F	116.2	110.0	115.6	118.4
" " " at gasifier, psig	46.0	39.4	38.0	38.0
" " " out exh. end, °F	140.6	139.4	140.0	136.0
" " " " scav. " , °F	141.6	138.0	136.8	133.4
Fresh water in, °F	134.0	134.0	132.8	131.8
" " out, °F	152.0	153.0	150.0	144.4
Gasifier #5 - Serial No. 94008				
Engine I.D.P. MM	20.0	20.0	24.2	29.8
Engine O.D.P. MM	490.0	486.8	468.0	442.4
Stab. setting MM	11.3	9.0	6.5	6.5
Fuel rack setting MM	35.0	37.3	32.6	27.3
Air to F.O. Accumul. Tank, psig	349.2	346.4	351.6	359.2
Piston cooling oil in exh. end, °F	108.6	107.1	107.0	120.4
" " " " scav. " , °F	107.0	106.5	105.8	118.6
" " " at gasifier, psig	50.0	33.6	30.0	30.0
" " " out exh. end, °F	141.4	137.6	133.6	135.4
" " " " scav. " , °F	135.8	137.2	133.2	136.6
Fresh water in, °F	138.0	135.3	136.8	135.0
" " out, °F	154.0	154.9	154.0	147.0

Bunker "C" Economy Runs

	6,000 SHP STAND-BY AUXILARIES	6,000 SHP MAX. POWER	4,000 SHP	2,000 SHP
Gasifier #6 - Serial No. 94007				
Engine I.D.P. MM	25.0	25.0	25.0	33.0
Engine O.D.P. MM	485.0	480.0	467.6	440.4
Stab. setting MM	10.0	11.3	11.6	11.5
Fuel rack setting MM	33.0	34.4	32.0	26.0
Air to F.O. Accumul. tank, psig	348.0	350.0	350.0	358.0
Piston cooling oil in exh. end, °F	108.0	107.1	108.2	118.8
" " "" scav. end, °F	109.6	107.0	108.4	119.6
" " " at gasifier, psig	No gauge	No gauge	No gauge	No gauge
" " " out exh. end, °F	139.4	139.1	137.4	138.4
" " " " scav. ", °F	138.6	137.3	135.8	138.4
Fresh water in, °F	135.2	136.4	137.2	135.0
" " out, °F	157.4	156.1	150.6	147.8
Piston cooling oil pump in operation	No. 1	No. 1	No. 1	No. 1
Piston cooling oil to pump, °F	138.4	134.2	131.2	128.4
Pump discharge to cooler, psig	64.4	68.4	59.4	59.6
Piston cooling oil from cooler, °F	116.2	108.7	116.0	118.8
Gasifiers being supplied, Nos.	1,2&3	1,2&3	1,2&3	1,2&3
Piston cooling oil pump in operation	No. 3	No. 3	No. 3	No. 3
Piston cooling oil to pump, °F	130.2	129.6	127.8	132.0
Pump discharge to cooler, psig	68.8	70.0	68.8	59.6
Piston cooling oil from cooler, °F	109.8	109.7	107.0	102.2
Gasifiers being supplied	4,5&6	4,5&6	4,5&6	4,5&6
L.O. pump in operation	Fwd.	Fwd.	Fwd.	Fwd.
L.O. pump suction, psig	3.0" Hg	3.0" Hg	3.0" Hg	3.0" Hg
L.O. pump discharge, psig	34.0	35.0	34.8	34.7
L.O. cooler in operation	Top	Top	Top	Top
L.O. to cooler, °F	136.4	133.4	133.6	132.6
L.O. from cooler, °F	124.6	119.3	122.8	125.2
L.O. to turbine, °F	124.6	119.4	122.8	125.2
High speed pinion forward, °F	146.4	144.5	143.8	139.6
" " " aft, °F	165.0	164.8	154.6	146.2
Port side-upper inter-1st stage gear - fwd., °F	133.2	128.7	130.0	130.0
Port side-upper inter-1st stage gear - aft, °F	134.4	130.6	131.2	130.4
Port side-upper inter-low speed pinion - fwd., °F	142.0	140.6	138.8	135.6
Port side-upper inter-low speed pinion - aft, °F	135.6	133.0	133.0	131.8
Port side-lower inter-thrust, °F	126.2	123.9	124.0	125.2
" " " " -1st stage gear - fwd., °F	131.0	129.9	131.2	128.6

	Bunker "C" Economy Runs			
	6000 SHP STAND-BY AUXILARIES	6,000 SHP MAX. POWER	4,000 SHP	2,000 SHP
Port side-lower inter-1st stage gear - aft, °F	136.2	134.6	133.2	130.8
Port side-lower inter-low speed pinion - Fwd., °F	137.2	135.9	134.6	132.0
Port side-lower inter-low speed pinion - aft, °F	134.4	131.3	131.4	129.8
Stbd. side-High speed pinion fwd. °F	150.6	148.6	143.8	139.6
" " " " " aft, °F	140.8	137.0	154.6	146.2
" " -Upper inter 1st stage gear - fwd., °F	132.6	129.4	130.0	130.0
Stbd. side-Upper inter 1st stage gear, aft - °F	135.4	133.0	131.2	130.4
Stbd. side-upper inter low speed pinion - fwd., °F	136.8	134.2	138.8	135.6
Stbd. side-upper inter low speed pinion - aft, °F	129.6	126.8	133.0	131.8
Stbd. side-lower inter-thrust, °F	127.6	125.3	124.4	125.2
Stbd. side-lower inter-1st stage gear, fwd. - °F	131.8	128.3	131.2	128.6
Stbd. side-lower inter-1st stage gear - aft, °F	133.6	131.0	133.2	130.8
Stbd. side-lower inter-low speed pinion - fwd., °F	138.8	135.1	134.6	132.0
Stbd. side-lower inter-low speed pinion - aft, °F	132.4	130.0	131.4	129.8
Thrust bearing, °F	130.0	127.7	127.6	130.2
Bull gear fwd. bearing, °F	126.8	123.6	124.0	127.0
Bull gear aft bearing, °F	118.0	116.5	117.8	123.8
L.O. System - Turbine and Gears				
Gas turb. port side-L.O. @ bearing, fwd., °F	176.8	179.2	176.2	164.4
Gas turb. port side-L.O.out fwd. °F	164.0	164.7	160.0	148.0
" " " " - " @ bearing aft, °F	149.6	150.8	147.6	144.4
Gas turb.-port side-L.O.@ out aft °F	135.0	133.1	133.8	131.0
" " " " L.O.@ thrust °F	172.8	173.4	167.6	153.0
" " " " L.O.@ bearings, psig	16.5	15.5	15.5	15.8
Gas turb.-stbd side-L.O. @ bearing fwd - °F	176.8	170.4	165.4	154.8
Gas turb.-stbd.side-L.O. out,fwd °F	164.0	160.4	156.0	146.2
" " " " L.O. @ bearing - aft, °F	149.6	153.8	149.6	139.4
Gas turb.-stbd.side-L.O. out,aft °F	134.6	136.2	137.0	135.6
" " " " L.O. @ thrust °F	172.8	166.5	161.2	151.2
" " " " L.O.@bearings psig	17.8	19.0	19.0	19.0

	Bunker "C" Economy Runs			
	6,000 SHP STAND-BY AUXILIARIES	6,000 SHP MAX. POWER	4,000 SHP	2,000 SHP
Fuel Oil Service System (Bunker "C")				
F.O. Service pump in operation	No. 1	Nos. 1&2	No. 2	No. 2
F.O. service pump discharge, psig	25.0	26.5	22.4	22.3
F.O. @ settling tank, °F	104.0	106.0	116.2	114.4
F.O. heater in operation	Top	Top	Top	Top
F.O. from heater, °F	195.2	193.7	198.8	192.2
F.O. from heater, psig	8.0	9.3	10.4	8.4
F.O. booster pump in operation	No. 1	Nos. 1&2	No. 2	No. 2
F.O. from booster pump, psig	31.4	23.0	24.8	25.6
F.O. feed pump in operation	No. 1	No. 1	No. 1	No. 1
F.O. from feed pump, psig	44.0	44.0	43.1	41.3
F.O. from 2nd heater, °F	196.2	195.1	196.2	196.8
F.O. from strainer, psig	3.1	3.1	2.9	2.9
F.O. centrifuge in operation	No. 1	Nos. 1&2	No. 2	No. 2
F.O. leak-off cumulation, Gals./hr.	2.2	0.2	0.05	0.2
Purifier No. 1 lead, Amps	25.0	25.0	0	0
Purifier No. 2-load, Amps	0	32.0	38.0	35.6
Diesel Oil Service System				
D.O. feed pump in operation	No. 1	No. 1	No. 1	Nos.1&2
D.O. feed pump discharge, psig	48.0	48.0	48.0	46.0
D.O. from strainer, psig	2.7	3.8	4.0	4.0
D.O. temp. @ strainer, °F	119.2	123.6	123.2	116.0
D.O. leak-off cumulation, Gals./Hr.	-	-	-	-
Fresh Water System and Boiler				
F.W. pump in operation	No. 1	No. 1	No. 1	No. 1
F.W. to cooler, °F	158.8	159.0	153.2	147.8
F.W. from cooler forward, °F	128.4	128.0	115.8	102.4
" " " aft, °F	126.4	125.9	114.0	100.2
Boiler in operation	Fwd	Fwd	Fwd	Fwd
Steam pressure, psig	198.0	193.5	196.6	197.2
F.O. supply, psig	304.0	308.2	300.0	302.0
F.O. return, psig	77.0	82.1	62.4	74.6
F.O. temp. @ burner, °F	197.8	202.1	198.6	193.0
Feed water to boilers, °F	114.6	119.4	127.4	119.2
" " " ", psig	210.0	201.0	211.6	208.4
Stack temperature, °F	453.0	473.9	482.0	490.0
Salt Water System				
S.W. pump in operation	No. 1	No. 1	No. 1	No. 1
S.W. pump disch. to cooler, psig	23.0	25.0	25.0	25.4
S.W. to coolers, °F	80.0	77.0	77.2	77.4
L.O. cooler in operation	Top	Top	Top	Top
S.W. from L.O. cooler	108.8	102.2	111.4	121.8
S.W. from piston C.O.coolers,fwd °F	91.2	90.0	86.6	84.0
" " " " " aft °F	89.2	87.9	86.0	83.6

	Bunker "C" Economy Runs			
	6,000 SHP STAND-BY AUXILARIES	6,000 SHP MAX. POWER	4,000 SHP	2,000 SHP
Salt Water System (cont'd)				
S.W. to P.C. oil coolers, fwd. °F	81.8	78.0	77.6	78.0
" " " " " aft °F	80.4	77.6	77.0	77.0
" from jacket water cooler fwd. °F	106.0	108.3	101.0	94.0
" " " " " aft °F	104.0	106.8	99.2	92.0
Sea temperature, °F	78.8	75.9	76.0	76.0
No. 1 Manometer				
Gasifier No. 1 Disch. Pot Pres., psig	36.6	43.1	secured	secured
" No. 2 " " " psig	35.7	42.0	38.0	32.2
" No. 3 " " " psig	35.6	43.0	38.2	32.3
" No. 4 " " " psig	34.4	40.2	36.9	Exh. to atmos.
" No. 5 " " " psig	34.5	40.1	36.5	30.0
" No. 6 " " " psig	34.2	40.4	36.8	30.3
Barometric pressure, "Hg	29.77	29.92	29.96	29.96
Port Turbine outboard inlet, psig	33.3	39.5	36.0	secured
" " inboard inlet, psig	33.3	39.6	36.0	29.4
Stbd. Turbine outboard inlet, psig	33.3	39.5	secured	secured
" " inboard inlet, psig	33.3	39.4	36.0	29.0
Manometer - Differential Pres. inlet-outlet				
L.O. cooler - Top, "Hg	0.2	0.3	0.2	0.2
" " - Bottom, "Hg	Out of order	Out of order	Out of order	Out of order
P.C. Cooler - Fwd., "Hg	4.0	4.1	4.0	4.0
" " - Aft, "Hg	4.5	4.6	4.6	4.6
Turbine exh. gas velocity - Port				
Center of Equal areas-inches from ref. point				
Station - 1 - Distance 3/4", ft./min.	3560	3729	3600	1640
" 2 " $2\frac{1}{2}$", ft./min.	4060	4564	4120	1920
" 3 " $4\frac{1}{2}$", ft./min.	4620	5179	4840	2400
" 4 " 6-7/8", ft./min.	4660	5321	5040	2720
" 5 " 15.0", ft./min.	4560	5321	4980	2400
" 6 " 23-1/8", ft./min.	4360	5093	4840	2540
" 7 " $25\frac{1}{2}$", ft./min.	4180	5050	4780	2540
" 8 " $27\frac{1}{2}$", ft./min.	3860	4721	4540	2540
" 9 " $29\frac{1}{4}$", ft./min.	3500	4300	4100	2240
Temperature, °F	534.0	599.9	555.6	543.0
Temperature correction factor	1.372	1.42	1.39	1.38
Average velocity, ft./min.	4151	4808	4537	2326
Corrected velocity, ft./min.	5696	6828	6311	3205
C.F.M.	26,354	33,511	30,974	15,728
Static pressure	0.29	0.33	0.37	0.04

	Bunker "C" Economy Runs			
	6,000 SHP STAND-BY AUXILARIES	6,000 SHP MAX. POWER	4,000 SHP	2,000 SHP
Turbine exh. gas velocity - Stbd. Center of equal areas-inches from ref. point				
Station - 1 - Distance 3/4", ft./min.	3920	3821	1440	1440
" 2 " 2½", ft./min.	4800	4593	1700	1700
" 3 " 4½", ft./min.	5200	5050	2280	2280
" 4 " 6-7/8", ft./min.	5260	5300	2300	2300
" 5 " 15.0", ft./min.	5360	5407	2680	2680
" 6 " 23-1/8", ft./min.	5040	5193	3160	3160
" 7 " 25½", ft./min.	4820	4964	3080	3080
" 8 " 27½", ft./min.	4660	4571	3040	3040
" 9 " 29¼", ft./min.	4120	4057	2280	2280
Temperature, °F	558.0	578.8	525.0	525.0
Temperature correction factor	1.390	1.40	1.37	1.37
Average velocity, ft./min.	4797	4773	2440	2440
Corrected velocity, ft./min.	6669	6704	3324	3324
C.F.M.	32,731	32,905	16,403	16,403
Static pressure	0.295	.33	.04	.04
Turbine exhaust gas - Orsat readings				
Port Turbine Exhaust - CO_2, %	3.04	3.2	1.8	1.8
" " " - O_2, %	15.5	14.5	15.0	15.0
" " " - CO, %	1.12	1.8	2.8	2.8
Stbd. Turbine Exhaust - CO_2, %	2.88	3.1	1.8	1.8
" " " - O_2, %	15.6	15.0	14.9	14.9
" " " - CO, %	1.16	1.7	2.9	2.9
Machinery Space Noise Levels (Decibels) Portable General Radio Co. Meter-Type 135A				
Fidley - Forward - Decibels	102.0	103.3		
" Aft "	102.8	111.7		
2nd Deck-Forward @ grating - Decibels	105.0	109.7		
" " Aft @ grating "	106.0	108.7		
17'-0" flat @ console "	109.4	112.3		
17'-0" flat @ generators "	111.4	112.7		
Engineers Work shop "	106.8	113.0		
17'-0" flat athwartship grating "	109.2	114.0		
Between gasifiers "	116.8	117.7		
Diesel Generator (Inboard)				
Engine speed, R.P.M.	400.0			
Salt water pump disch., psig	11.0			
Fresh water pump disch, psig	27.7			
Lube oil to bearings, psig	46.0			
Lube oil pump discharge, psig	58.0			

	Bunker "C" Economy Runs			
	6,000 SHP STAND-BY AUXILARIES	6,000 SHP MAX. POWER	4,000 SHP	2,000 SHP
Diesel Generator (Inboard) - Cont'd.				
Fuel oil to injection pumps, psig	22.0			
Fuel oil supply pump disch., psig	43.8			
Fresh water to engine, °F	140.8			
Fresh water from engine, °F	143.4			
Starting air, psig	320.0			
Lube oil to engine, °F	131.8			
Lube oil to lube oil cooler, °F	137.0			
Lube oil from lube oil cooler, °F	131.6			
Salt water to lube oil cooler, °F	78.8			
Salt water from lube oil cooler, °F	78.4			
Salt water from fresh water cooler, °F	83.6			
Fresh water to fresh water cooler, °F	143.6			
Generator - volts	230.0			
" - amps	398.0			
" - K.W.	91.5			
Eng. cylinder exh. temp.-No.1 cyl., °F	370.0			
" " " " No.2 cyl., °F	351.0			
" " " " No.3 cyl., °F	341.0			
" " " " No.4 cyl., °F	340.0			
" " " " No.5 cyl., °F	329.0			
" " " " No.6 cyl., °F	337.0			
" " " " all cyl. combined	338.0			
Diesel Generator - Outboard				
Engine R.P.M.	400.0	400.0	400.0	400.0
Salt water pump disch., psig	10.0	10.4	11.0	11.0
Fresh water pump disch., psig	28.4	28.0	28.0	28.0
Lube oil to bearings, psig	42.0	42.0	42.0	42.0
Lube oil pump disch., psig	53.2	54.0	54.0	54.0
Fuel oil to injection pumps, psig	30.0	30.0	30.0	30.0
Fuel oil supply pump disch., psig	31.0	30.6	30.4	31.0
Fresh water to engine, °F	140.4	138.6	138.6	138.0
Fresh water from engine, °F	142.6	143.2	143.4	142.8
Starting air, psig	316.0	320.0	320.0	320.0
Lube oil to engine, °F	130.4	130.0	130.0	130.0
Lube oil to lube oil cooler, °F	137.8	136.8	137.4	136.7
Lube oil from lube oil cooler, °F	130.6	130.1	130.0	130.0
Salt water to lube oil cooler, °F	77.2	75.8	75.6	76.0
Salt water from lube oil cooler, °F	78.6	75.8	75.6	76.0
Salt water from fresh water cooler, °F	82.0	79.6	79.0	79.2
Fresh water to fresh water cooler, °F	145.8	145.3	145.2	145.0

	Bunker "C" Economy Runs			
	6,000 SHP STAND-BY AUXILARIES	6,000 SHP MAX. POWER	4,000 SHP	2,000 SHP
Diesel Generator - Outboard (Cont'd)				
Generator - Volts	230.0	230.0	230.0	230.0
" - Amps	391.0	775.0	786.0	798.0
" - K.W.	89.9	178.3	180.8	183.5
Eng. cylinder exh. temp.-No.1 cyl. °F	373.0	505.3	515.0	506.0
" " " " No.2 cyl. °F	348.0	510.7	522.0	518.0
" " " " No.3 cyl. °F	350.0	519.6	523.0	515.0
" " " " No.4 cyl. °F	338.0	517.5	522.0	515.0
" " " " No.5 cyl. °F	358.0	526.8	534.0	528.0
" " " " No.6 cyl. °F	340.0	505.7	510.0	505.0
" " " " all cyl.combined	330.0	492.5	500.0	495.0

APPENDIX - D

Summary of Machinery Trial Data - Power Range Runs

POWER RANGE RUNS

	3994 SHP	3834 SHP	2648 SHP	2529 SHP
GENERAL				
Date	9-6-57	9-6-57	9-6-57	9-6-57
Trial SHP	3994	3834	2648	2529
Trial RPM	87.2	87.4	77.3	76.5
Duration, Hrs.	1	1	1	1
No. gasifiers in use	6	5	4	3
Gas valves open - port turbine	2	2	1	0
" " " - stbd. turbine	2	2	2	2
FUEL CONSUMPTION				
Gasifiers Supply				
*Meter 2023417, gal.	753.0	818.0	796.7	758.5
**Correction factor	.990	.9920	.9920	.9910
Correct gallons	745.5	811.5	790.3	751.7
*Meter 2023419, gal.	764.7	822.0	800.0	763.3
**Correction factor	.9875	.9880	.9880	.9875
Correct gallons	755.1	812.1	790.4	753.8
Average correct gallons	750.3	811.8	790.4	752.8
Temp. thru meters, °F	185	185	186	187
Wt. oil, lbs./gal.	7.771	7.771	7.7675	7.7650
Total oil supplied, lbs./hr.	5830.6	6308.5	6139.4	5845.5
Injector Return				
*Meter 2023416, gal.	497.0	544.0	580.0	581.0
**Correction factor	1.002	1.002	1.002	1.002
Correct gallons	498.0	545.1	581.2	582.2
*Meter 2023418, gal.	495.0	543.0	579.0	578.0
**Correction factor	.9980	.9995	1.000	1.000
Correct gallons	494.0	542.7	579.0	578.0
Average correct gallons	496.0	543.9	580.1	580.1
Temp. thru meters, °F	193	194	196	198
Wt. oil, lbs./gal.	7.7475	7.7450	7.740	7.7340
F.O. injector return, lbs./hr.	3842.8	4212.5	4490.0	4486.5
F.O. Header Return				
Meter 1252735, gal.	3.0	1.8	1.75	2.25
**Correction factor	.988	.988	.988	.988
Correct gallons	3.0	1.8	1.7	2.2
Temp. thru meter, °F	113	108	107	106
Wt. oil, lbs./gal.	7.975	7.992	7.9950	7.9975
F.O. header return, lbs./hr.	23.9	14.4	13.6	17.6

	3994 SHP	3834 SHP	2648 SHP	2529 SHP
Gasifier Fuel Consumption				
Total F.O. supplied, lbs./hr.	5830.6	6308.5	6139.4	5845.5
Total F.O. returned, lbs./hr.	3866.7	4226.9	4503.6	4504.1
F.O. consumed (as burned) (18,335 BTU/lb.) lbs./hr.	1963.9	2081.6	1635.8	1341.4
F.O. consumed (corrected to 18,500 BTU/lb.) lbs./hr.	1946.4	2063.0	1621.2	1329.4
Fuel rate, lbs./SHP-Hr.	.4873	.5381	.6122	.5257
Generators (Diesel)				
Outboard Generator, K.W.	94.7	88.2	92.8	91.2
Inboard Generator, K.W.	88.6	95.1	92.0	91.2
Diesel Oil Supply				
Meter 2023415, gal.	20.8	20.6	20.5	20.8
**Correction factor	1.015	1.015	1.015	1.015
Correct gallons	21.1	20.9	20.8	21.1
Meter 2023414, gal.	19.5	19.3	19.3	19.3
**Correction factor	1.075	1.075	1.075	1.075
Correct gallons	21.0	20.7	20.7	20.7
Average correct gallons	21.1	20.8	20.8	20.9
Temp. thru meters, °F	118	118	118	117
Wt. D.O., lbs./gal.	6.816	6.816	6.816	6.820
D.O. consumed (as burned 19,605 BTU/lb.) lbs./hr.	143.8	141.8	141.8	142.5
Oil consumed (corrected to 18,500 BTU/lb.) lbs./hr.	152.4	150.3	150.3	151.1
Boilers				
Supply				
*Meter 2023421, gal.	115.0	115.8	115.3	133.5
**Correction factor	.9920	.9920	.9920	.9920
Correct gallons	114.1	114.8	114.3	132.4
*Meter 2023419, gal.	115.0	115.8	115.3	133.5
**Correction factor	.9860	.9860	.9860	.9860
Correct gallons	113.4	114.2	113.6	131.6
Average correct gallons	113.8	114.5	114.0	132.0
Temp. thru meters, °F	108	105	103	102
Wt. oil, lbs./gal.	7.992	8.000	8.007	8.010
F.O. supplied, lbs./hr.	909.5	916.0	912.8	1057.3

	3994 SHP	3834 SHP	2648 SHP	2529 SHP
Boilers (Cont'd)				
Return				
*Meter 1252737, gal.	95.5	97.0	96.0	112.5
**Correction factor	.931	.930	.930	.918
Correct gallons	88.9	90.2	89.3	103.3
*Meter 1060330, gal.	85.0	85.5	85.0	100.0
**Correction factor	1.031	1.031	1.031	1.028
Correct gallons	87.6	88.2	87.6	102.8
Average correct gal.	88.3	89.2	88.5	103.1
Temp. thru meters, ^{o}F	127	119	118	123
Wt. oil, lbs./gal.	7.9375	7.935	7.961	7.948
F.O. returned, lbs./hr.	700.9	707.8	704.5	819.4
F.O. consumed (as burned 18,335 BTU/lb.) lbs./hr.	208.2	208.2	208.3	237.9
F.O. consumed (corrected to 18,500 BTU/lb.) lbs./hr.	206.7	206.3	206.4	235.8
ALL PURPOSE				
Total fuel consumption (18,500 BTU/lb.) lbs./hr.	2305.5	2419.6	1977.9	1716.3
All purpose fuel rate (18,500 BTU/lb.) lbs./SHP-Hr.	.5772	.6311	.7469	.6786

* One of two meters connected in series. Readings of the two meters corrected by the meter factor and averaged is considered as the correct flow measurement.

** From pre-trial calibration.

G.T.V. WILLIAM PATTERSON
Official Trials

GENERAL DATA

		Power Range Runs			
		3,994 SHP	3,834 SHP	2,648 SHP	2,529 SHP
Time		0755-0855	1050-1150	1210-1310	1330-1430
Date		9-6-57	9-6-57	9-6-57	9-6-57
Eng. exh. pot temp. °F -	#1 Gasifier	791.7	811.7	790.0	866.7
	#2 Gasifier	720.0	556.7*	468.3*	398.3*
	#3 Gasifier	756.6	758.3	566.7*	495.0*
	#4 Gasifier	753.3	788.3	766.7	853.3
	#5 Gasifier	705.0	750.0	736.7	615.0*
	#6 Gasifier	726.7	748.3	726.7	816.7
* Gasifier not in operation					
Scavenging Air temp., °F	#1 Gasifier	371.6	381.7	376.7	405.0
	#2 Gasifier	358.3	251.7*	146.7*	126.7*
	#3 Gasifier	361.7	368.3	260.0*	151.7*
	#4 Gasifier	366.7	373.3	368.3	398.3
	#5 Gasifier	368.3	383.3	376.7	338.3*
	#6 Gasifier	386.7	393.3	388.3	426.7
Gas in outboard inlet, °F-	Port Turbine	780.0	820.0	791.7	665.0
Gas in inboard inlet, °F-	" "	775.0	786.7	713.3	611.7
Casing ahead, °F -	" "	773.0	813.3	781.7	666.7
Casing astern, °F -	" "	425.0	696.7	680.0	708.3
Casing exhaust, °F -	" "	-	426.0	481.7	551.7
Forward bearing, °F -	" "	133.3	143.3	135.0	133.3
After bearing, °F	" "	133.3	133.3	128.3	128.3
Gas in outboard inlet, °F	Stbd. Turbine	723.3	743.3	725.0	830.0
Gas in inboard inlet, °F	" "	743.3	761.7	740.0	866.7
Casing ahead, °F -	" "	721.7	743.3	721.7	826.7
Casing astern, °F -	" "	633.3	648.3	600.0	588.3
Casing exhaust, °F -	" "	475.0	500.0	491.7	505.0
Forward bearing, °F -	" "	135.0	138.3	133.3	133.3
After bearing, °F -	" "	130.0	130.0	126.7	128.3
Port piston cooling oil to gasifier,psig		51.7	52.8	47.6	48.0
Stbd. " " " " " ,psig		49.0	52.0	50.6	49.5
Gas manifold, psig		30.0	28.7	27.0	36.0
Gear & turb. L.O. press., psig		18.5	18.5	18.5	18.5
Heavy fuel oil feed, psig		43.5	38.0	40.7	43.3
Light fuel oil feed, psig		42.2	41.6	41.8	41.5
Salt water, psig		26.7	26.5	26.5	26.5
Fresh water, psig		37.0	37.0	37.0	37.0
Starting air pressure, psig		568.3	568.3	571.7	563.3
Hydraulic oil pressure, psig		106.7	108.0	108.7	109.0

* Gasifier not in operation

	Power Range Runs			
	3,994 SHP	3,834 SHP	2,648 SHP	2,529 SHP
Turb. inlet valve position #1 valve, Stbd. inboard	Open	Open	Open	Open
Turb. inlet valve position #2 valve, Port outboard	Open	Open	Open	Open
Turb. inlet valve position #3 valve, Stbd. outboard	Open	Open	Open	Open
Turb. inlet valve position #4 valve, Port inboard	Open	Open	Closed	Closed
Ambient air temp., °F	94.6	95.0	96.3	96.7
Cycles per minute - #1 Gasifier	Broken Counter	Broken Counter	Broken Counter	Broken Counter
#2 Gasifier	571.3	On By-Pass	On By-pass	On By-pass
#3 Gasifier	523.3	530.7	On By-pass	On By-pass
#4 Gasifier	523.3	530.0	520.0	552.0
#5 Gasifier	523.3	532.7	526.0	On By-pass
#6 Gasifier	522.0	531.3	526.0	562.7
Gasifier No. 1 - Serial No. 94009				
Engine I.D.P. MM	35.0	26.7	28.3	30.0
Engine O.D.P. MM	433.3	460.0	456.6	450.0
Stab. setting MM	0.8	1.0	1.0	1.0
Fuel rack setting MM	2.6	3.1	3.0	3.2
Air to F.O. Accumul Tank, psig	350.0	346.7	363.3	355.0
Piston cooling oil in exh. end, °F	113.4	110.0	114.7	115.7
Piston cooling oil in scav. end, °F	111.3	109.3	112.7	114.0
Piston cooling oil at gasifier, psig	32.0	30.0	30.0	28.7
Piston cooling oil out esh. end, °F	140.0	142.6	144.7	147.3
Piston cooling oil out scav. end, °F	131.3	132.0	134.0	136.0
Fresh water in, °F	134.7	132.3	131.3	131.3
Fresh water out, °F	150.0	150.0	148.7	150.0
Gasifier No. 2 - Serial No. 94010				
Engine I.D.P. MM	35.0	25.0	Not	Not
Engine O.D.P. MM	440.0	460.0	in	in
Stab. setting MM	1.4	1.4	Operation	Operation
Fuel rack setting MM	2.7	2.7	"	"
Air to F.O. Accumul Tank, psig	350.0	310.0	"	"
Piston cooling oil in exh. end, °F	112.0	108.0	"	"
Piston cooling oil in scav. end, °F	114.0	112.0	"	"
Piston cooling oil at gasifier, psig	38.0	38.0	"	"
Piston cooling oil out exh. end, °F	134.0	132.0	"	"
Piston cooling oil out scav. end, °F	132.0	138.0	"	"
Fresh water in, °F	134.0	132.0	"	"
Fresh water out, °F	146.0	142.0		

		Power Range Runs			
		3,994 SHP	3.834 SHP	2,648 SHP	2,529 SHP
Gasifier No. 3 - Serial No. 94006					
Engine I.D.P.	MM	35.0	30.0	30.0	Not
Engine O.D.P.	MM	440.0	470.0	450.0	in
Stab. setting	MM	10.0	15.0	15.0	Operation
Fuel rack setting	MM	29.0	33.0	26.0	"
Air to F.O. Accumul. Tank, psig		371.7	373.3	375.0	"
Piston cooling oil in exh. end, °F		114.0	110.3	112.0	"
Piston cooling oil in scav. end, °F		115.0	111.7	115.0	"
Piston cooling oil at gasifier, psig		26.7	25.3	26.0	"
Piston cooling oil out exh. end, °F		138.0	139.0	144.0	"
Piston cooling oil out scav. end, °F		128.0	129.0	126.0	"
Fresh water in, °F		135.0	132.0	134.0	"
Fresh water out, °F		150.6	150.0	146.0	"
Gasifier No. 4 - Serial No. 94011					
Engine I.D.P.	MM	25.0	20.0	20.0	21.3
Engine O.D.P.	MM	440.0	470.0	470.0	470.0
Stab. setting	MM	15.0	15.0	15.0	15.0
Fuel rack setting	MM	28.0	32.0	27.6	34.0
Air to F.O. Accumul. tank, psig		350.0	350.0	350.0	350.0
Piston cooling oil in exh. end, °F		108.0	105.7	107.6	110.0
Piston cooling oil in scav. end, °F		117.6	113.7	115.0	116.0
Piston cooling oil at gasifier, psig		26.7	25.3	25.0	25.0
Piston cooling oil out exh. end, °F		142.7	146.3	145.0	150.7
Piston cooling oil out scav. end, °F		132.0	132.0	130.0	134.3
Fresh water in, °F		135.0	132.0	132.0	131.7
Fresh water out, °F		148.3	148.7	146.0	149.0
Gasifier No. 5 - Serial No. 94008					
Engine I.D.P.	MM	25.0	19.3	18.0	21.2
Engine O.D.P.	MM	450.7	481.7	482.0	459.3
Stab. setting	MM	12.5	12.7	12.5	12.5
Fuel rack setting	MM	28.0	33.8	32.7	30.2
Air to F.O. Accumul tank, psig		351.7	350.7	352.0	304.3
Piston cooling oil in exh. end, °F		117.3	110.3	112.0	116.0
Piston cooling oil in scav. end, °F		115.0	111.0	111.3	112.7
Piston cooling oil at gasifier, psig		30.0	30.0	30.0	30.0
Piston cooling oil out exh. end, °F		135.3	137.6	138.0	133.3
Piston cooling oil out scav. end, °F		136.3	137.0	137.0	135.0
Fresh water in, °F		135.0	134.3	133.7	131.7
Fresh water out, °F		148.0	149.3	148.3	142.7
Gasifier No. 6 - Serial No. 94007					
Engine I.D.P.	MM	30.0	24.0	22.3	21.7
Engine O.D.P.	MM	452.3	474.7	472.3	480.0
Stab. setting	MM	10.0	11.3	11.2	10.8
Fuel rack setting	MM	28.8	30.2	28.3	33.0
Air to F.O. Accumul. tank, psig		352.0	352.3	352.0	350.7

	Power Range Runs			
	3,994 SHP	3,834 SHP	2,648 SHP	2,529 SHP
Gasifier No. 6 - Serial No. 94007 (Cont'd)				
Piston cooling oil in exh. end, °F	115.3	112.3	113.3	117.0
Piston cooling oil in scav. end, °F	115.3	112.0	112.3	115.3
Piston cooling oil at gasifier, psig	No gauge	No gauge	No gauge	No gauge
Piston cooling oil out exh. end, °F	138.0	136.7	138.0	142.7
Piston cooling oil out scav. end, °F	138.0	137.0	137.7	142.0
Fresh water in, °F	136.0	134.6	133.7	133.7
Fresh water out, °F	150.3	148.6	147.3	150.0
Piston cooling oil pump in operation	No. 1	No. 1	No. 1	No. 1
Piston cooling oil to pump, °F	132.0	132.0	126.0	124.0
Pump discharge to cooler, psig	62.7	61.0	59.3	59.0
Piston cooling oil from cooler, °F	115.0	111.3	115.1	115.7
Gasifiers being supplied, Nos.	1,2&3	1,2&3	1,2&3	1,2&3
Piston cooling oil pump in operation	No. 3	No. 3	No. 3	No. 3
Piston cooling oil to pump, °F	131.3	132.0	132.0	133.0
Pump discharge to cooler, psig	60.7	61.0	62.6	63.0
Piston cooling oil from cooler, °F	104.0	107.7	106.7	107.0
Gasifiers being supplied	4,5&6	4,5&6	4,5&6	4,5&6
L.O. pump in operation	Aft	Aft	Aft	Aft
L.O. pump suction, psig	3.0" Hg	3.0" Hg	3.0" Hg	3.0" Hg
L.O. pump discharge, psig	35.3	35.3	35.5	35.8
L.O. cooler in operation	Top	Top	Top	Top
L.O. to cooler, °F	132.0	133.6	131.0	131.7
L.O. from cooler, °F	121.7	125.0	122.7	124.7
L.O. to turbine, °F	121.7	125.0	122.7	124.7
High speed pinion forward, °F	141.7	144.0	139.0	140.3
" " " aft, °F	147.7	149.3	145.0	153.7
Port side-upper inter-1st stage gear fwd - °F	129.0	131.3	128.3	130.0
Port side-upper inter-1st stage gear aft - °F	130.3	132.0	128.0	130.0
Port side-upper inter-L.S. pinion fwd °F	136.7	138.0	133.3	131.7
" " " " " " aft °F	132.0	134.3	131.0	129.7
" " lower inter-thrust, °F	123.7	125.3	123.3	124.3
" " " " 1st stage gear fwd - °F	128.0	130.0	125.7	128.0
Port side-lower inter-1st stage gear aft - °F	131.7	132.2	129.3	129.3
Port side-lower inter-L.S. pinion fwd °F	132.7	133.3	130.3	130.3
" " " " " " aft °F	130.3	131.3	127.0	128.3
Stbd. side-H.S. pinion fwd., °F	141.7	146.0	139.3	141.7
" " " " aft, °F	147.7	138.0	133.7	135.0

	Power Range Runs			
	3,994 SHP	3,834 SHP	2,648 SHP	2,529 SHP
Stbd. side-upper inter-1st stage gear, fwd - °F	129.0	132.0	128.7	130.7
Stbd. side-upper inter-1st stage gear, aft - °F	130.3	134.0	131.8	133.7
Stbd. side-upper inter-L.S. pinion fwd °F	136.7	134.7	131.3	133.7
" " " " " " aft °F	132.0	129.3	127.0	128.3
" " lower inter-thrust, °F	123.7	127.0	124.8	126.0
" " " " -1st stage gear fwd. - °F	128.0	130.3	127.0	128.3
Stbd. side-lower inter-1st stage gear aft - °F	131.7	132.7	129.7	129.0
Stbd. side-lower inter-L.S. pinion fwd °F	132.7	136.0	132.3	134.7
" " " " " " aft °F	130.3	131.3	129.0	130.3
Thrust bearing, °F	127.0	128.0	127.7	127.0
Bull gear fwd bearing, °F	122.7	125.3	124.7	124.0
Bull gear aft bearing, °F	118.3	121.3	120.3	118.3
L.O. System - Turbine and Gears				
Gas Turb.-Port Side-L.O. @ bearing fwd °F	171.3	174.3	162.6	157.3
" " " " L.O. out, fwd. °F	154.7	153.7	148.6	148.3
" " " " " @ bearing aft °F	146.0	148.0	145.0	145.7
" " " " " out, aft - °F	130.0	133.3	131.7	128.0
" " " " " @ thrust, °F	165.3	167.0	154.0	153.0
" " " " " @ bearings, psig	16.5	16.5	16.5	16.5
Gas Turb.-Stbd.Side-L.O.@ bearing fwd °F	160.3	163.0	156.7	158.3
" " " " " out, fwd. °F	152.3	154.0	146.7	148.7
" " " " " @ bearing aft °F	145.0	150.3	143.7	143.3
" " " " " out, aft °F	135.7	137.0	134.0	133.0
" " " " " @ thrust, °F	157.7	160.3	154.0	155.3
" " " " " @ bearings,psig	19.0	19.0	19.0	19.0

	Power Range Runs			
	3,994 SHP	3,834 SHP	2,648 SHP	2,529 SHP
Fuel Oil Service System (Bunker "C")				
F.O. service pump in operation	No. 2	No. 2	No. 2	No. 2
F.O. service pump discharge, psig	23.7	26.0	21.6	21.0
F.O. @ settling tank, °F	107.3	104.3	103.3	102.0
F.O. heater in operation	Top	Top	Top	Top
F.O. from heater, °F	190.7	193.3	190.7	191.3
F.O. from heater, psig	8.3	11.0	10.7	10.0
F.O. booster pump in operation	No. 2	No. 2	No. 2	No. 2
F.O. from booster pump, psig	30.3	34.0	32.5	27.8
F.O. feed pump in operation	No. 2	No. 2	No. 2	No. 2
F.O. from feed pump, psig	44.0	37.8	40.3	44.0
F.O. from 2nd heater, °F	201.3	198.3	199.3	201.0
F.O. from strainer, psig	3.9	3.7	3.7	4.0
F.O. centrifuge in operation	No. 2	No. 1	No. 1	No. 1
F.O. leak-off cumulation, gals./hr.	0	0	0	0
Purifier No. 1 load, amps	0	25.0	25.0	25.0
Purifier No. 2 load, amps	34.3	0	0	0
Diesel Oil Service System				
D.O. feed pump in operation	No. 2	No. 2	No. 2	No. 2
D.O. feed pump discharge, psig	46.3	46.7	46.0	46.0
D.O. from strainer, psig	4.0	4.0	4.0	4.0
D.O. temperature @ strainer, °F	118.0	118.3	116.3	116.3
D.O. leak-off cumulative, gals./hr.	-	-	-	-
Fresh Water System and Boiler				
F.W. pump in operation	No. 1	No. 1	No. 1	No. 1
F.W. to cooler, °F	152.0	150.3	146.7	146.7
F.W. from cooler forward, °F	112.0	113.7	105.7	104.0
" " " aft, °F	110.0	111.3	103.7	102.0
Boiler in operation	aft	aft	aft	aft
Steam pressure, psig	201.0	179.0	180.3	192.7
F.O. supply, psig	310.0	310.0	310.0	310.0
F.O. return, psig	140.0	128.3	135.3	113.3
F.O. temperature @ burner, °F	166.7	195.7	200.0	193.7
Feed water to boilers, °F	110.0	110.6	110.0	110.0
" " " " , psig	200.0	189.3	190.7	199.3
Stack temperature, °F	406.7	416.7	418.3	415.0
Salt Water System				
S.W. pump in operation	No. 2	No. 2	No. 2	No. 2
S.W. pump discharge to cooler, psig	29.0	29.0	29.0	29.0
S.W. to coolers, °F	78.0	79.0	79.3	78.7

	Power Range Runs			
	3,994 SHP	3,834 SHP	2,648 SHP	2,529 SHP
Salt Water System (Cont'd)				
L.O. cooler in operation	Top	Top	Top	Top
S.W. from L.O. cooler, °F	111.3	118.0	113.3	120.0
S.W. from piston C.O. coolers fwd °F	86.0	88.0	84.7	84.0
" " " " " aft °F	84.6	86.3	86.0	86.0
" to P.C. oil coolers, fwd. °F	79.0	79.0	79.0	79.0
" " " " " aft, °F	78.0	78.3	78.7	78.0
" from jacket water cooler fwd., °F	99.6	100.6	96.3	95.0
" " " " aft, °F	97.7	98.7	94.0	93.3
Sea temperature, °F	76.0	76.0	78.0	78.0
No. 1 Manometer				
Gasifier No. 1 Disch. Pot Pres., psig	32.9	32.6	39.0	39.0
No. 2 " " " ,psig	32.2	exh.to atmos.	secured	secured
No. 3 " " " ,psig	32.4	32.1	secured	secured
No. 4 " " " ,psig	30.4	29.9	36.3	
No. 5 " " " ,psig	30.3	30.1	exh.to atmos	exh.to atmos
Barometric pressure, "Hg	30.0	30.02	30.03	30.02
Port Turbine Outboard Inlet, psig	29.6	28.3	secured	secured
" " Inboard Inlet, psig	29.5	28.0	secured	secured
Stbd.Turbine Outboard Inlet, psig	29.2	28.2	34.7	34.7
" " Inboard Inlet, psig	29.7	28.3	35.4	35.4
Manometer - Differential Press. Inlet-Outlet				
L.O. cooler - Top, "Hg	0.2	0.2	0.2	0.2
" " Bottom, "Hg	Not in Operation	Not in Operation	Not in Operation	Not in Operation
P.C. cooler - Fwd., "Hg	4.7	5.0	5.0	5.0
" " - aft, "Hg	5.8	6.0	6.0	6.0
Turbine Exhaust Gas Velocity - Port				
Center of Equal areas - inches from ref. point				
Station - 1 - Distance 3/4", ft./min.	2733	2133	2500	4000
" 2 " 2½", ft./min.	3567	3000	3100	5000
" 3 " 4½", ft./min.	3800	3200	3400	5333
" 4 " 6-7/8", ft./min.	4000	3533	3467	5133
" 5 " 15.0", ft./min.	4167	3500	3600	4767
" 6 " 23-1/8", ft./min.	4467	3733	3467	4367
" 7 " 25½", ft./min.	4467	3667	3200	4400
" 8 " 27½", ft./min.	4267	3433	3100	4500
" 9 " 29¼", ft./min.	4267	2967	2500	4400
Temperature, °F	496.7	520.0	508.3	561.7
Temperature correction factor	1.347	1.343	1.358	1.387
Average velocity, ft./min.	3914	3240	3148	4656
Corrected velocity, ft./min.	5271	4354	4275	6456
C.F.M.	25,870	21,370	20,984	31,684
Static pressure	0.22	0.19	0.21	0.45

	Power Range Runs			
	3,994 SHP	3,834 SHP	2,648 SHP	2,529 SHP
Turbine Exhaust Gas Velocity-Stbd. Center of Equal Areas-inches from ref. point				
Station - 1 Distance 3/4", ft./min.	2733	2133	2500	4000
" 2 " 2½", ft./min.	3567	3000	3100	5000
" 3 " 4½", ft./min.	3800	3200	3400	5333
" 4 " 6-7/8", ft./min.	4000	3533	3467	5133
" 5 " 15.0", ft./min.	4167	3500	3600	4767
" 6 " 23-1/8", ft./min.	4467	3733	3467	4367
" 7 " 25½", ft./min.	4467	3667	3200	4400
" 8 " 27½", ft./min.	4267	3433	3100	4500
" 9 " 29¼", ft./min.	3767	2967	2500	4400
Temperature, °F	496.7	520.0	508.3	561.7
Temperature correction factor	1.347	1.343	1.358	1.387
Average velocity, ft./min.	3914	3240	3148	4656
Corrected velocity, ft./min.	5271	4354	4275	6456
C.F.M.	25,870	21,370	20,984	31,684
Static pressure	0.217	0.19	0.21	0.45
Turbine Exhaust Gas - Orsat Readings				
Port Turbine Exhaust - CO_2, %	2.5	2.0	2.3	secured
" " " - O_2, %	14.9	14.9	14.4	secured
" " " - CO, %	2.2	2.6	2.5	secured
Stbd. Turbine Exhaust- CO_2, %	2.1	2.0	2.3	2.5
" " " - O_2, %	14.6	14.5	14.3	14.1
" " " - CO, %	2.5	2.8	2.8	2.3
Machinery Space Noise Levels (Decibels) Portable General Radio Co. meter-Type 135A				
Fidley - Forward, Decibels	101.0	104.0		
" - Aft "	115.0	103.0		
2nd Deck - Forward @ grating, Decibels	111.0	106.0		
" " - Aft @ grating "	110.0	106.0		
17'-0" flat @ console "	112.0	110.0		
17'-0" flat @ generators "	112.0	111.0		
Engineers Work Shop "	115.0	109.0		
17'-0" flat athwartship grating, "	112.0	110.0		
Between gasifiers "	118.0	117.0		
Diesel Generator (Inboard)				
Engine speed, R.P.M.	400.0	400.0	400.0	400.0
Salt water pump disch., psig	11.0	11.0	11.0	11.0
Fresh water pump disch., psig	27.5	27.2	27.0	27.3
Lube oil to bearings, psig	46.0	46.0	46.0	46.0
Lube oil pump disch., psig	58.0	58.0	58.0	58.0
Fuel oil to injection pumps, psig	21.0	21.0	21.0	21.0
Fuel oil supply pump disch., psig	43.0	43.0	43.0	43.0

	Power Range Runs			
	3,994 SHP	3,834 SHP	2,648 SHP	2,529 SHP
Diesel Generator (Inboard) - Cont'd.				
Fresh water to engine, °F	140.0	140.0	140.0	140.0
Fresh water from engine, °F	145.0	145.0	145.0	145.0
Starting air, psig	320.0	320.0	320.0	320.0
Lube oil to engine, °F	128.3	128.0	129.6	130.0
Lube oil to lube oil cooler, °F	134.7	134.0	135.3	136.0
Lube oil from lube oil cooler, °F	129.3	129.0	129.7	130.0
Salt water to lube oil cooler, °F	77.3	78.0	78.0	78.0
Salt water from lube oil cooler	78.3	78.0	78.0	78.0
Salt water from fresh water cooler, °F	80.3	82.0	82.0	82.0
Fresh water to fresh water cooler, °F	143.3	143.3	143.0	143.7
Generator - volts	230.0	230.0	230.0	230.0
" amps	385.0	410.0	400.0	396.7
" KW	88.6	95.1	92.0	91.2
Eng. cylinder Exh. temp.-No.1Cyl, °F	361.7	371.7	360.0	365.0
" " " " No.2 Cyl., °F	345.0	355.0	341.7	346.7
" " " " No.3 Cyl., °F	336.7	345.0	331.7	336.7
" " " " No.4 Cyl., °F	331.7	340.0	328.3	331.7
" " " " No.5 Cyl., °F	325.0	331.7	321.7	325.0
" " " " No.6 Cyl., °F	330.0	340.0	326.7	326.7
" " " " all cyl.combined	333.3	340.0	331.7	331.7
Diesel Generator (Outboard)				
Engine R.P.M.	400.0	400.0	400.0	400.0
Salt water pump disch., psig	10.0	10.0	10.0	10.0
Fresh water pump disch., psig	28.0	28.0	28.0	28.0
Lube oil to bearings, psig	42.0	42.0	42.0	42.0
Lube oil pump disch., psig	54.0	54.0	54.0	54.0
Fuel oil to injection pumps, psig	31.0	31.0	31.0	31.0
Fuel oil supply pump disch., psig	31.0	31.0	31.0	31.0
Fresh water to engine, °F	140.0	140.0	140.0	140.0
Fresh water from engine, °F	143.3	143.0	142.7	143.0
Starting air, psig	320.0	320.0	320.0	320.0
Lube oil to engine, °F	130.0	130.0	130.0	130.0
Lube oil to lube oil cooler, °F	137.0	137.0	137.0	137.0
Lube oil from lube oil cooler, °F	130.0	130.0	130.0	130.0
Salt water to lube oil cooler, °F	76.0	76.7	78.0	78.0
Salt water from lube oil cooler, °F	76.0	78.0	78.0	78.0
Salt water from fresh water cooler, °F	80.3	81.3	80.3	80.3
Fresh water to fresh water cooler, °F	145.0	144.0	145.0	144.7
Generator - Volts	230.0	230.0	230.0	230.0
" Amps	411.7	383.3	403.3	396.7
" K.W.	94.7	88.1	92.8	91.2
Eng. cylinder exh. temp.-No.1 cyl. °F	353.3	338.3	343.3	345.0
" " " " No.2 cyl. °F	360.0	345.0	345.0	345.0
" " " " No.3 cyl. °F	365.0	355.0	356.7	358.3
" " " " No.4 cyl. °F	351.7	343.3	346.7	345.0
" " " " No.5 cyl. °F	373.3	360.0	365.0	365.0
" " " " No.6 cyl. °F	358.3	345.0	351.7	346.7
" " " " all cyl.combined	340.0	330.0	335.0	330.0

APPENDIX - E

Summary of Machinery Trial Data - Power Range, Astern and Diesel Fuel Runs

GENERAL	Power Range Run	Astern Run	Diesel Fuel
Date	9-5-57	9-6-57	9-4-57
Trial SHP	1670	1265	4636
Trial RPM	66.9	62.4	92.0
Duration, Hrs.	1	3/4	2
No. Gasifiers in use	3	6	6
Gas valves open - port turbine	1	-	2
" " " - stbd. turbine	1	-	2
FUEL CONSUMPTION			
Gasifiers Supply			
* Meter 2023417, Gal	1028.7	561.0	
* D.O. meter 11486426, Gal.			1646.0
** Correction factor	.9910	.990	.980
Correct gallons	1019.4	555.4	1613.1
*Meter 2023419, Gal.	1028.0	573.0	
*D.O. Meter 11486425, Gal.			1639.0
**Correction factor	.9898	.9875	.990
Correct gallons	1017.5	565.8	1622.6
Average correct gallons	1018.5	560.6	1617.9
Temp. thru meters, °F	188	183	124
Wt. oil, lbs./gal.	7.7625	7.7765	6.797
Total oil supplied, lbs./hr.	7906.5	5812.8	5498.4
Injector Return			
*Meter 2023416, Gal.	742.0	390.0	
*D.O. Meter 11486433, Gal.			1016.0
**Correction factor	1.003	1.000	.976
Correct gallons	744.2	390.0	991.6
*Meter 2023418, Gal.	744.0	390.0	
*D.O. Meter 11486435, Gal.			1007.0
**Correction factor	1.002	.997	.988
Correct gallons	745.5	388.8	994.9
Average correct gallons	744.9	389.4	993.3
Temp. thru meters, °F	197	193	132
Wt. oil, lbs./gal.	7.7370	7.7475	6.773
F,O. injector return, lbs./hr.	5763.3	4022.5	3363.8
F.O. Header Return			
Meter 1252735, Gal.	110.0	2.0	
D.O. Meter 1252736, Gal.			2.25
**Correction factor	.988	.988	.992
Correct gallons	108.7	2.0	2.2
Temp. thru meter, °F	187	108	115

F.O. Header Return (Cont'd)

Wt. oil, lbs./gal.	7.7650	7.9920	6.825
F.O. Header return, lbs./hr.	844.1	21.3	7.5

Gasifier Fuel Consumption

Total F.O. supplied, lbs./hr.	7906.5	5812.8	
Total D.O. supplied, lbs./hr.			5498.4
Total F.O. returned, lbs./hr.	6607.4		
Total D.O. returned, lbs./hr.		4043.8	3371.3
F.O. consumed (as burned 18,335 BTU/lb.) lbs./hr.	1299.1	1769.0	
D.O. consumed (as burned 19,605 BTU/lb.) lbs./hr.			2127.1
F.O. consumed (corrected to 18,500 BTU/lb.) lbs./hr.	1287.5	1753.2	
D.O. consumed (corrected to 19,350 BTU/lb.) lbs./hr.			2155.2
Fuel rate (based on 18,500 BTU/lb.) Lbs./SHP-Hr.	.7710	1.3859	
Fuel rate (based on 19,350 BTU/lb) Lbs./SHP-Hr.			.4649

Generators (Diesel)

Outboard Generator, K.W.	184.8	100.6	89.9
Inboard generator, K.W.	–	92.0	91.3

Diesel Oil Supply

*Meter 2023415, Gal.	15.5	15.7	39.0
**Correction factor	1.015	1.015	1.017
Correct gallons	15.7	15.9	39.7
*Meter 2023414, Gal.	12.9	14.8	33.9
Correction factor	1.075	1.075	1.076
Correct gallons	13.9	15.9	36.5
Average correct gallons	14.8	15.9	38.1
Temp. thru meters, °F	117	118	123
Wt. D.O., Lbs./gal.	6.820	6.816	6.800
D.O. consumed (as burned 19,605 BTU/Lb.) lbs./hr.	100.9	144.5	132.6
Oil consumed (corrected to 18,500 BTU/Lb.) Lbs./Hr.	107.0	151.7	
D.O. consumed (corrected to 19,350 BTU/Lb.) Lbs./Hr.			134.4

Boilers Supply			
*Meter 2023421, gal.	115.5	101.5	234.0
**Correction factor	.992	.992	.992
Correct gallons	114.6	100.7	232.1
*Meter 2023419	115.5	101.5	233.0
**Correction factor	.986	.986	.986
Correct gallons	113.9	100.1	229.7
Average correct gallons	114.3	100.4	230.9
Temp. thru meters, °F	115	105	104
Wt. oil, lbs./gal.	7.972	8.000	8.003
F.O. supplied, lbs./hr.	911.2	1070.9	924.0
Return			
*Meter 1252737, gal.	93.0	83.0	199.3
**Correction factor	.930	.933	.930
Correct gallons	86.5	77.4	185.3
*Meter 1060330, Gal.	83.5	74.0	177.0
**Correction factor	1.03	1.028	1.028
Correct gallons	86.0	76.1	182.0
Average correct gal.	86.3	76.8	183.7
Temp. thru meters, °F	125	122	123
Wt. oil, lbs./gal.	7.943	7.952	7.950
F.O. returned, lbs./hr.	685.5	814.4	730.2
F.O. consumed (as burned 18,335 BTU/Lb.) Lbs./Hr.	225.7	256.5	193.8
F.O. consumed (corrected to 18,500 BTU/Lb.) Lbs./Hr.	223.7	254.2	
F.O. consumed (corrected to 19,350 BTU/Lb.) Lbs./Hr.			183.6
ALL PURPOSE			
Total Fuel consumed (18,500 BTU/Lb.) Lbs./Hr.	1618.2	2159.1	
Total fuel consumed (19,350 BTU/Lb.) Lbs./Hr.			2473.2
All purpose fuel rate (18,500 BTU/Lb.) Lbs./SHP-Hr.	.9790	1.7068	
All purpose fuel rate (19,350 BTU/Lb.) Lbs./SHP-Hr.			.5335

* One of two meters connected in series. Readings of the two meters corrected by the meter factor is considered as the correct flow measurement.

** From pre-trial calibration

GENERAL

		Power Range	Astern Run	Diesel Fuel
		1670 SHP	1265 SHP	4636 SHP
Time		1540-1640	0935-1020	1600-1800
Date		9/5/57	9/6/57	9/4/57
Engine Exhaust Pot. Temperature °F.	#1 Gasifier	271.7*	772.5	791.0
	#2 Gasifier	573.3*	705.0	753.0
	#3 Gasifier	725.0	713.8	761.0
	#4 Gasifier	595.0*	738.8	772.0
	#5 Gasifier	703.3	690.0	737.0
	#6 Gasifier	720.0	707.5	757.0
*Gasifier not in Operation				
Scavenging Air Temperature °F.	#1 Gasifier	95.0*	361.3	406.0
	#2 Gasifier	250.0*	346.3	399.0
	#3 Gasifier	360.0	348.8	392.0
	#4 Gasifier	135.0*	355.0	403.0
	#5 Gasifier	361.6	358.8	399.0
	#6 Gasifier	376.6	367.5	407.0
Gas in Outboard Inlet °F.	Port Turbine	673.3	761.3	799.0
Gas in Inboard Inlet °F.	Port Turbine	730.0	747.5	790.0
Casing Ahead °F.	Port Turbine	676.6	960.0	790.0
Casing Astern °F.	Port Turbine	566/7	757.5	677.0
Casing Exhaust °F.	Port Turbine	448.3	482.5	511.0
Forward Bearing °F.	Port Turbine	136.7	140.0	140.0
After Bearing °F.	Port Turbine	128.3	130.0	132.0
Gas in Outboard Inlet °F.	Stbd Turbine	631.7	698.8	750.0
Gas in Inboard Inlet °F.	Stbd Turbine	706.7	715.0	768.0
Casing Ahead °F.	Stbd Turbine	646.7	880.0	749.0
Casing Astern °F.	Stbd Turbine	591.7	697.5	634.0
Casing Exhaust °F.	Stbd Turbine	543.3	618.8	479.0
Forward Bearing °F.	Stbd Turbine	133.3	130.0	134.0
After Bearing °F.	Stbd Turbine	128.3	125.0	129.0
Port Piston Cooling Oil to Gasifier Psig		47.0	50.6	55.4
Starboard Piston Cooling Oil to Gasifier Psig		47.0	46.8	57.0
Gas Manifold Psig		25.8	27.8	33.7
Gear and Turbine Lube Oil Pressure Psig		18.5	18.5	18.5
Heavy Fuel Oil Feed Psig		42.0	45.5	36.8
Light Fuel Oil Feed Psig		42.7	42.0	39.8
Salt Water Psig		22.8	26.5	22.5
Fresh Water Psig		36.2	37.0	37.0
Starting Air Pressure Psig		573.3	571.3	574.0
Hydraulic Oil Pressure Psig		108.0	102.5	109.0
Turbine Inlet Valve Position	#1 Valve Stbd Inbd	Open	Open	Open
	#2 Valve Port Outbd	Closed	Open	Open
	#3 Valve Stbd Outbd	Closed	Open	Open
	#4 Valve Port Inbd	Open	Open	Open
Ambient Air Temperature °F.		93.8	93.3	99.5

* Gasifier not in operation

GENERAL (Cont'd)	Power Range	Astern Run	Diesel Fuel
Time	1540-1640	0935-1020	1600-1800
Date	9/5/57	9/6/57	9/4/57
Cycles per minute #1 Gasifier	Off	Broken Counter	546.0
#2 Gasifier	To Atmos.	591.5	561.2
#3 Gasifier	525.3	509.0	546.8
#4 Gasifier	Off	507.0	541.5
#5 Gasifier	510.0	508.0	539.5
#6 Gasifier	520.0	496.5	568.0
Gasifier No. 1, Serial No. 94009			
Engine I.D.P. MM	Not	36.3	30.0
Engine O.D.P. MM	In	425.0	460.0
Stab. Setting MM	Operation	0.8	8.0
Fuel Rack Setting MM	"	2.4	32.8
Air to F. O. Accumulating Tank Psig	"	345.0	313.0
Piston Cooling Oil in Exh. End °F.	"	115.7	110.0
Piston Cooling Oil in Scav. End °F.	"	113.8	109.6
Piston Cooling Oil at Gasifier Psig	"	30.5	30.0
Piston Cooling Oil out Exh. End °F.	"	138.5	136.8
Piston Cooling Oil out Scav. End °F.	"	130.5	134.0
Fresh Water In °F.	"	131.0	136.4
Fresh Water Out °F.	"	143.5	152.0
Gasifier No. 2, Serial No. 94010			
Engine I.D.P. MM	25.0	38.7	25.0
Engine O.D.P. MM	450.0	425.0	476.0
Stab. Setting MM	24.0	1.4	14.0
Fuel Rack Setting MM	25.0	2.4	34.8
Air to F. O. Accumulating Tank Psig	310.0	348.8	310.0
Piston Cooling Oil in Exh. End °F.	119.0	113.5	110.0
Piston Cooling Oil in Scav. End °F.	122.5	116.8	112.0
Piston Cooling Oil at Gasifier Psig	39.0	38.0	46.0
Piston Cooling Oil Out Exh. End °F.	135.0	134.0	134.0
Piston Cooling Oil Out Scav. End °F.	140.0	132.0	136.0
Fresh Water In °F.	128.0	129.0	134.0
Fresh Water Out °F.			
Gasifier No. 3, Serial No. 94006			
Engine I.D.P. MM	25.0	40.0	30.0
Engine O.D.P. MM	481.6	430.0	470.0
Stab. Setting MM	10.0	10.0	7.0
Fuel Rack Setting MM	32.0	25.5	33.0
Air to F. O. Accumulating Tank Psig	355.0	375.0	340.0
Piston Cooling Oil in Exh. End °F.	121.7	114.7	110.0
Piston Cooling Oil in Scav. End °F.	122.7	117.0	113.4

	Power Range	Astern Run	Diesel Run
GENERAL (Cont'd)			
Time	1540-1640	0935-1020	1600-1800
Date	9/5/57	9/6/57	9/4/57
Gasifier No. 3, Serial No. 94006 (Cont'd)			
Piston Cooling Oil at Gasifier Psig	29.3	26.0	34.3
Piston Cooling Oil Out Exh. End °F.	145.3	137.5	136.6
Piston Cooling Oil Out Scav. End °F.	136.3	128.3	130.0
Fresh Water In °F.	127.0	130.5	136.0
Fresh Water Out °F.	143.3	144.8	153.0
Gasifier No. 4, Serial No. 94011			
Engine I.D.P. MM	Not	30.0	22.0
Engine O.D.P. MM	In	430.0	470.0
Stab. Setting MM	Operation	15.0	15.0
Fuel Rack Setting MM	"	24.5	34.0
Air to F. O. Accumulating Tank Psig	"	350.0	310.0
Piston Cooling Oil in Exh. End °F.	"	109.8	106.8
Piston Cooling Oil in Scav. End °F.	"	120.8	107.8
Piston Cooling Oil at Gasifier Psig	"	25.5	26.8
Piston Cooling Oil Out Exh. End °F.	"	142.8	135.4
Piston Cooling Oil Out Scav. End °F.	"	132.0	130.0
Fresh Water In °F.	"	130.5	138.0
Fresh Water Out °F.	"	143.0	151.2
Gasifier No. 5, Serial No. 94008			
Engine I.D.P. MM	20.0	30.0	25.0
Engine O.D.P. MM	482.0	431.3	470.0
Stab. Setting MM	6.5	12.5	11.7
Fuel Rack Setting MM	32.0	25.5	35.0
Air to F. O. Accumulating Tank Psig	359.0	351.5	305.0
Piston Cooling Oil in Exh. End °F.	117.3	120.5	106.6
Piston Cooling Oil in Scav. Eng °F.	114.3	118.0	105.0
Piston Cooling Oil at Gasifier Psig	30.0	30.0	50.0
Piston Cooling Oil out Exh. End °F.	138.0	134.8	135.8
Piston Cooling Oil out Scav. End °F.	138.0	137.0	130.4
Fresh Water In °F.	127.3	131.5	134.8
Fresh Water Out °F.	143.0	143.5	152.0

GENERAL (Cont'd)	Power Range	Astern Run	Diesel Run
Time	1540-1640	0935-1020	1600-1800
Date	9/5/57	9/6/57	9/4/57
Gasifier No. 6, Serial No. 94007			
Engine I.D.P. MM	22.6	35.8	25.0
Engine O.D.P. MM	477.0	429.8	465.0
Stab. Setting MM	11.5	10.0	10.2
Fuel Rack Setting MM	29.8	23.4	30.6
Air to F. O. Accumulating Tank Psig	354.0	350.0	310.0
Piston Cooling Oil in Exh. End °F.	117.0	120.2	104.0
Piston Cooling Oil in Scav. End °F.	116.6	120.2	105.0
Piston Cooling Oil at Gasifier Psig	No Gauge	No Gauge	No Gauge
Piston Cooling Oil out Exh. End °F.	139.5	136.7	132.8
Piston Cooling Oil out Scav. Eng °F.	140.0	136.6	130.4
Fresh Water In °F.	128.7	132.5	135.8
Fresh Water Out °F.	143.0	143.3	152.8
Piston Cooling Oil Pump in Operation	No. 1	No. 1	No. 1
Piston Cooling Oil to Pump °F.	130.7	131.5	131.6
Pump Discharge to Cooler Psig	58.3	60.8	65.6
Piston Cooling Oil from Cooler °F.	122.7	116.5	110.6
Gasifiers Being Supplied Nos.	1, 2 & 3	1, 2 & 3	1, 2 & 3
Piston Cooling Oil Pump in Operation	No. 3	No. 3	No. 3
Piston Cooling to Pump °F.	125.3	132.5	125.2
Pump Discharge to Cooler Psig	60.0	60.0	69.6
Piston Cooling Oil from Cooler °F.	99.0	102.0	107.4
Gasifiers Being Supplied Nos.	4, 5 & 6	4, 5 & 6	4, 5 & 6
L. O. Pump in Operation	Fwd.	Aft.	Fwd.
L. O. Pump Suction Psig	3.0" HG	3.0" HG	3.0" HG
L. O. Pump Discharge Psig	34.5	35.4	34.6
L. O. Cooler in Operation	Top	Top	Top
L. O. to Cooler °F.	132.3	128.5	133.6
L. O. from Cooler °F.	126.3	122.0	122.4
L. O. to Turbine °F.	126.3	122.0	122.2
High Speed Pinion Forward °F.	138.6	138.5	143.8
High Speed Pinion Aft	144.3	140.5	160.0

GENERAL (Cont'd)

	Power Range	Astern Run	Diesel Run
Time	1540-1640	0935-1020	1600-1800
Date	9/5/57	9/6/57	9/4/57
Port Side-Upper Inter 1st Stage Gear Fwd °F	130.0	128.5	130.6
" " " " " " " Aft °F	130.3	125.8	131.6
" " " " Low Speed Pinion Fwd °F	125.3	128.0	139.4
Port Side-Upper Inter Low Speed Pinion Aft °F	131.3	125.3	133.4
Port Side Lower Inter Thrust °F	125.3	122.8	124.6
Port Side Lower Inter 1st Stage Gear Fwd °F	127.7	124.0	130.4
" " " " " " " Aft °F	130.3	128.0	133.4
" " " " Low Speed Pinion Fwd °F	131.7	129.3	133.8
Port Side Lower Inter Low Speed Pinion Aft °F	129.3	127.5	131.0
Starboard Side-High Speed Pinion Fwd °F	138.6	138.5	146.4
" " " " " Aft °F	144.3	140.5	137.2
" " Upper Inter 1st Stage Gear Fwd °F	130.0	128.5	130.6
Starboard Side Upper Inter 1st Stage Gear Aft °F	130.3	125.8	133.0
Starboard Side Upper Inter Low Speed Pinion Fwd °F	135.3	128.0	133.6
Starboard Side Upper Inter Low Speed Pinion Aft °F	131.3	125.3	127.4
Starboard Side Lower Inter Thrust °F	125.3	122.8	126.4
Starboard Side Lower Inter 1st stage gear Fwd °F	127.7	124.0	130.2
Starboard Side Lower Inter 1st stage gear Aft °F	130.3	128.0	131.0
Starboard Side Lower Inter Low Speed Pinion Fwd °F	131.7	129.3	135.2
Starboard Side Lower Inter Low Speed Pinion Aft °F	129.3	127.5	129.6
Thrust Bearing °F	130.0	127.3	128.0
Bull Gear Fwd Bearing °F	127.0	123.8	125.2
Bull Gear Aft Bearing °F	124.0	119.8	117.2
L. O. System - Turbine and Gears			
Gas Turbine-Port Side-L.O. @ Bearing Fwd °F	163.6	172.3	176.0
Gas Turbine-Port Side-L.O. @ Out Fwd °F	146.6	141.8	158.6
Gas Turbine-Port Side-L.O. @ Bearing Aft °F	144.6	147.3	146.2

GENERAL (Cont'd)

	Power Range	Astern Run	Diesel Run
Time	1540-1640	0935-1020	1600-1800
Date	9/5/57	9/6/57	9/4/57
L. O. System - Turbine and Gears (Cont'd)			
Gas Turbine-Port Side-L.O. @ Out Aft °F	131.3	130.0	132.8
Gas Turbine-Port Side-L.O.@ Thrust °F	151.0	146.0	167.0
Gas Turbine-Port Side-L.O. @ Bearings Psig	16.0	16.5	16.2
Gas Turbine-Starboard Side-L.O. @ Bearing Fwd °F	152.6	149.8	164.8
Gas Turbine-Starboard Side-L.O. @ Out Fwd °F	144.6	142.3	156.2
Gas Turbine-Starboard Side-L.O. @ Bearing Aft °F	142.0	145.3	149.8
Gas Turbine-Starboard Side-L.O. @ Out Aft °F	135.7	133.0	136.2
Gas Turbine-Starboard Side-L.O. @ Thrust °F	148.0	145.3	161.6
Gas Turbine-Starboard Side-L.O. @ Bearings Psig	19.0	19.0	19.0

GENERAL (Cont'd)	Power Range	Astern Run	Diesel Run
Time	1540-1640	0935-1020	1600-1800
Date	9/5/57	9/6/57	9/4/57
Fuel Oil Service System (Bunker "C")			
F. O. Service Pump in Operation	No. 2	No. 2	No. 1
F. O. Service Pump Discharge Psig	23.1	21.3	25.0
F. O. at Settling Tank °F	114.3	105.0	104.0
F. O. Heater in Operation	Top	Top	Top
F. O. from Heater °F	196.5	196.5	195.2
F. O. from Heater Psig	9.3	8.1	8.0
F. O. Booster Pump in Operation	No. 2	No. 2	No. 1
F. O. from Booster Pump Psig	24.8	35.0	31.4
F. O. Feed Pump in Operation	No. 1	No. 2	No. 1
F. O. from Feed Pump Psig	42.6	46.0	36.6
F. O. from 2nd Heater °F	198.0	200.2	197.6
F. O. from strainer Psig	3.3	3.8	3.1
F. O. Centrifuge in Operation	No. 2	Nos. 1 & 2	No. 1
F. O. Leak-off Cumulation Gals/hr	0	0	0
Purifier No. 1 load Amps	0	25.0	25.0
Purifier No. 2 load Amps	34.7	47.0	0
Diesel Oil Service System			
D. O. Feed Pump in Operation	No. 1	No. 2	No. 1
D. O. Feed Pump Discharge Psig	47.3	47.0	44.6
D. O. from strainer Psig	4.0	4.0	1.9
D. O. Temperature at strainer °F	118.3	118.8	123.8
D. O. Leak-off Cumulation Gals/hr	0	0	3.87
Fresh Water System and Boiler			
F. W. Pump in Operation	No. 1	No. 1	No. 1
F. W. to Cooler °F	139.3	146.7	153.2
F. W. from Cooler Forward °F	97.3	108.7	122.0
F. W. from Cooler Aft °F	94.6	106.8	119.6
Boiler in Operation	Fwd	Aft	Fwd
Steam Pressure Psig	203.7	189.3	195.6
F. O. Supply Psig	301.6	310.0	305.0
F. O. Return Psig	58.3	127.5	84.0
F. O. Temperature at Burner °F	195.7	177.5	200.0
Feed Water to Boilers °F	139.3	111.0	116.0
Feed Water to Boilers Psig	215.0	198.8	205.6
Stack Temperature °F	460.0	402.5	458.0

	Power Range	Astern Run	Diesel Run
GENERAL (Cont'd)			
Time	1540-1640	0935-1020	1600-1800
Date	9/5/57	9/6/57	9/4/57
Salt Water System			
S. W. Pump in Operation	No. 1	No. 2	No. 1
S. W. Pump Discharge to Cooler Psig	25.0	29.0	23.0
S. W. to Cooler °F	77.6	78.7	80.0
L. O. Cooler in Operation	Top	Top	Top
S. W. from L. O. Cooler	123.7	118.5	108.8
S. W. from Piston C. O. Coolers Fwd °F	83.0	86.0	91.2
S. W. from Piston C. O. Coolers Aft °F	82.0	84.0	89.2
S. W. to P. C. Oil Coolers Fwd °F	77.0	78.8	81.8
S. W. to P. C. Oil Coolers Aft °F	76.7	78.0	80.4
S. W. from Jacket Water Cooler Fwd °F	91.3	97.5	106.0
S. W. from Jacket Water Cooler Aft °F	88.7	95.0	104.0
Sea Temperature °F	76.0	76.0	78.8
No. 1 Manometer			
Gasifier No. 1 Disch. Pot Press., psig	secured	30.2	36.6
" No. 2 " " " , psig	Exh.to atmos.	29.4	35.7
" No. 3 " " " , psig	29.0	30.2	35.6
" No. 4 " " " , psig	secured	28.2	34.4
" No. 5 " " " , psig	26.5	28.3	34.5
" No. 6 " " " , psig	26.6	28.4	34.2
Barometric pressure, "Hg	29.95	30.00	29.77
Port Turbine Outboard Inlet, psig	secured	27.3	33.3
" " Inboard Inlet, psig	25.5	27.3	33.3
Stbd. " Outboard Inlet, psig	secured	27.1	33.3
" " Inboard Inlet, psig	25.5	27.3	33.3
Manometer - Differential Press. Inlet-Outlet			
L.O. cooler - Top, "Hg	0.2	0.2	0.2
" " - Bottom, "Hg	Out of order	Out of order	Out of order
P.C. cooler - Fwd, "Hg	4.0	4.9	4.0
" " - Aft, "Hg	4.6	5.9	4.5
Turbine Exhaust Gas Velocity - Port			
Center of Equal Areas - inches from ref. point			
Station - 1 - Distance 3/4", ft./min.	1200	3100	3520
" 2 " $2\frac{1}{2}$", ft./min.	1467	3500	3920
" 3 " $4\frac{1}{2}$", ft./min.	1933	3800	4200
" 4 " 6-7/8", ft./min.	2133	3800	4640
" 5 " 15.0", ft./min.	1933	3750	4680
" 6 " 23-1/8", ft./min.	1867	3550	4420
" 7 " $25\frac{1}{2}$", ft./min.	1933	3400	4100
" 8 " $27\frac{1}{2}$", ft./min.	1900	3350	4000
" 9 " $29\frac{1}{4}$", ft./min.	1667	3000	3520

GENERAL (Cont'd)	Power Range	Astern Run	Diesel Run
Time	1540-1640	0935-1020	1600-1800
Date	9/5/57	9/6/57	9/4/57
Turbine Exhaust Gas Velocity - Port Center of Equal Areas-inches from ref. point (Cont'd)			
Temperature, °F	561.7	622.5	501.0
Temperature correction factor	1.39	1.443	1.350
Average velocity, ft./min.	1848	3472	4111
Corrected velocity, ft./min.	2479	5008	5550
C.F.M.	12,165	24,580	27,238
Static pressure	0.02	-	0.29
Turbine Exhaust Gas Velocity - Starboard Center of Equal Areas-inches from ref. point			
Station - 1 - Distance 3/4", ft./min.	1450	3100	3520
" 2 " 2½", ft./min.	1650	3500	3920
" 3 " 4½", ft./min.	1867	3800	4200
" 4 " 6-7/8", ft./min.	1867	3800	4640
" 5 " 15.0", ft./min.	2367	3750	4680
" 6 " 23-1/8", ft./min.	2733	3550	4420
" 7 " 25½", ft./min.	2667	3400	4100
" 8 " 27½", ft./min.	2200	3350	4000
" 9 " 29¼", ft./min.	2067	3000	3520
Temperature, °F	541.6	622.5	501.0
Temperature correction factor	1.38	1.443	1.350
Average velocity, ft./min.	2096	3472	4111
Corrected velocity, ft./min.	2885	5008	5550
C.F.M.	14,159	24,580	27,238
Static Pressure	-	-	0.29
Turbine Exhaust Gas - Orsat Readings			
Port Turbine Exhaust - CO_2, %	2.1	2.0	2.55
" " " - O_2, %	15.3	14.9	15.75
" " " - CO, %	2.3	2.6	1.3
Stbd. Turbine Exhaust - CO_2, %	2.0	2.0	2.4
" " " - O_2, %	14.2	14.5	16.0
" " " - CO, %	3.4	2.8	1.4
Machinery Space Noise Levels (Decibels) Portable General Radio Co. Meter - Type 135A			
Fidley - Forward Decibels	100.0	101.0	101.0
" - Aft "	100.0	115.0	102.0
2nd Deck - Forward @ grating "	102.0	111.0	105.0
" " - Aft @ grating "	102.0	110.0	105.0

GENERAL (Cont'd)	Power Range	Astern Run	Diesel Run
Time	1540-1640	0935-1020	1600-1800
Date	9/5/57	9/6/57	9/4/57
Machinery Space Noise Levels (Decibels) Portable General Radio Co. Meter-Type 135A (Cont'd)			
17'-0" flat @ console Decibels	105.0	112.0	106.4
17'-0" flat @ generators "	107.0	112.0	109.0
Engineers Work Shop "	104.0	115.0	106.4
17'-0" flat athwartship grating "	105.0	112.0	107.8
Between gasifiers "	113.0	118.0	113.6
Diesel generator (Inboard)			
Engine speed, R.P.M.		400.0	400.0
Salt water pump discharge, psig		11.0	11.0
Fresh water pump discharge, psig		27.5	27.9
Lube oil to bearings, psig		46.0	45.8
Lube oil pump discharge, psig		58.0	58.0
Fuel oil to injection pumps, psig		21.0	22.4
Fuel oil supply pump disch., psig		43.0	43.0
Fresh water to engine, °F		140.0	140.0
Fresh water from engine, °F		145.0	145.0
Starting air, psig		320.0	320.0
Lube oil to engine, °F		128.0	132.8
Lube oil to lube oil cooler, °F		133.0	137.4
Lube oil from lube oil cooler, °F		129.0	131.4
Salt water to lube oil cooler, °F		78.5	79.2
Salt water from lube oil cooler, °F		79.0	79.2
Salt water from fresh water cooler, °F		82.0	82.4
Fresh water to fresh water cooler, °F		143.0	144.0
Generator - volts		230.0	230.0
" - amps		400.0	397.0
" - K.W.		92.0	91.3
Eng. cylinder exh. temp.-No.1 cyl., °F		367.5	367.0
" " " " No.2 cyl., °F		346.2	348.0
" " " " No.3 cyl., °F		337.5	339.0
" " " " No.4 cyl., °F		332.5	335.0
" " " " No.5 cyl., °F		326.3	326.0
" " " " No.6 cyl., °F		331.3	333.0
" " " " all cyl. combined		335.0	337
Diesel Generator - Outboard			
Engine R.P.M.	400.0	400.0	400.0
Salt water pump disch., psig	11.0	10.0	10.8
Fresh Water pump disch., psig	28.0	28.0	28.1

GENERAL (Cont'd)	Power Range	Astern Run	Diesel Run
Time	1540-1640	0935-1020	1600-1800
Date	9/5/57	9/6/57	9/4/57
Diesel Generator - Outboard (Cont'd)			
Lube oil to bearings, psig	42.0	42.0	42.0
Lube oil pump disch., psig	54.0	54.0	54.0
Fuel oil to injection pumps, psig	30.0	31.0	30.0
Fuel oil supply pump disch., psig	31.0	31.3	30.8
Fresh water to engine, °F	138.0	140.8	140.8
Fresh water from engine, °F	142.8	143.5	144.6
Starting air, psig	320.0	320.0	320.0
Lube oil to engine, °F	130.0	130.0	131.6
Lube oil to lube oil cooler, °F	136.3	137.0	138.4
Lube oil from lube oil cooler, °F	130.0	130.0	131.8
Salt water to lube oil cooler, °F	76.0	76.3	79.2
Salt water from lube oil cooler, °F	76.0	76.3	78.2
Salt water from fresh water cooler, °F	79.2	82.0	81.8
Fresh water to fresh water cooler, °F	145.0	145.0	145.8
Generator - Volts	230.0	230.0	230.0
" Amps	803.0	437.5	391.0
" K.W.	184.8	100.6	89.9
Eng. cylinder exh. temp.-No. 1 cyl., °F	506.7	352.5	369.0
" " " " No. 2 cyl., °F	520.0	357.5	349.0
" " " " No. 3 cyl., °F	520.0	365.0	348.0
" " " " No. 4 cyl., °F	518.3	352.5	339.0
" " " " No. 5 cyl., °F	533.3	371.3	358.0
" " " " No. 6 cyl., °F	508.3	355.0	340.0
" " " " all cyl. combined	498.3	338.8	329.0

APPENDIX - F

Maneuvering Curves

(a) Left Circle Test

(b) Left Circle Radar Plot

(c) Right Circle Test

(d) Right Circle Radar Plot

(e) "Z" Maneuver Data Sheet

G.T.V. WILLIAM PATTERSON

SECTION: 5

DATE: 9-4-57

LEFT CIRCLE TEST

TEST DATA:

Clock Time: 11:08 START (6 MIN. 52 SEC. TOTAL TIME)

Base Course: 25°

R.P.M. at Start: 100

R.P.M. at Finish: 91

Wind Velocity: (Estimated) 16 MPH

Wind Direction: (Estimated) SOUTH

Wave Size: (Estimated) 1 FT.

Wave Direction: (Estimated) SOUTH

Heel of Ship (Average): 40 SECONDS

Heel of Ship (Max.): 1 DEGREE

Steering Gear Ram Press. (Max.): 500 P.S.I.

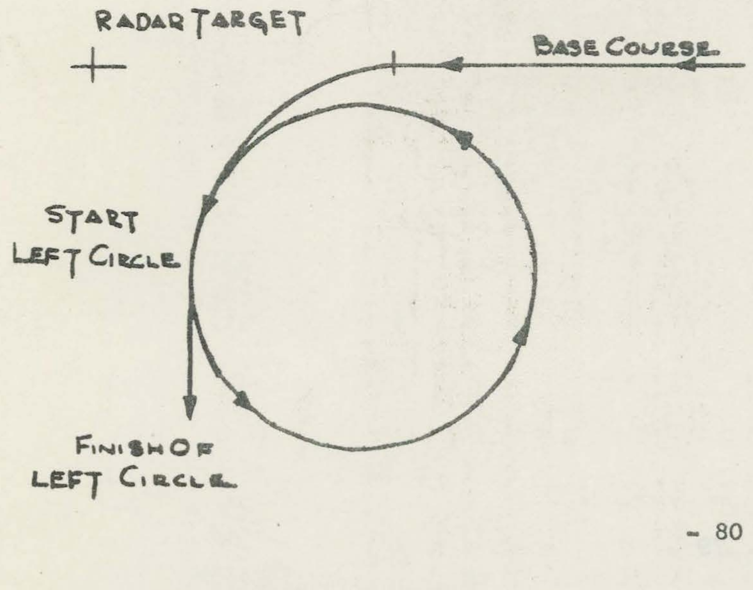
Steering Gear Ram Press. (Steady): 250 P.S.I.

Depth of Water: 80 FT. TO 100 FT.

Weather: CLOUDY

MAX. RUDDER ANGLE 35°

DIAGRAM OF LEFT CIRCLE

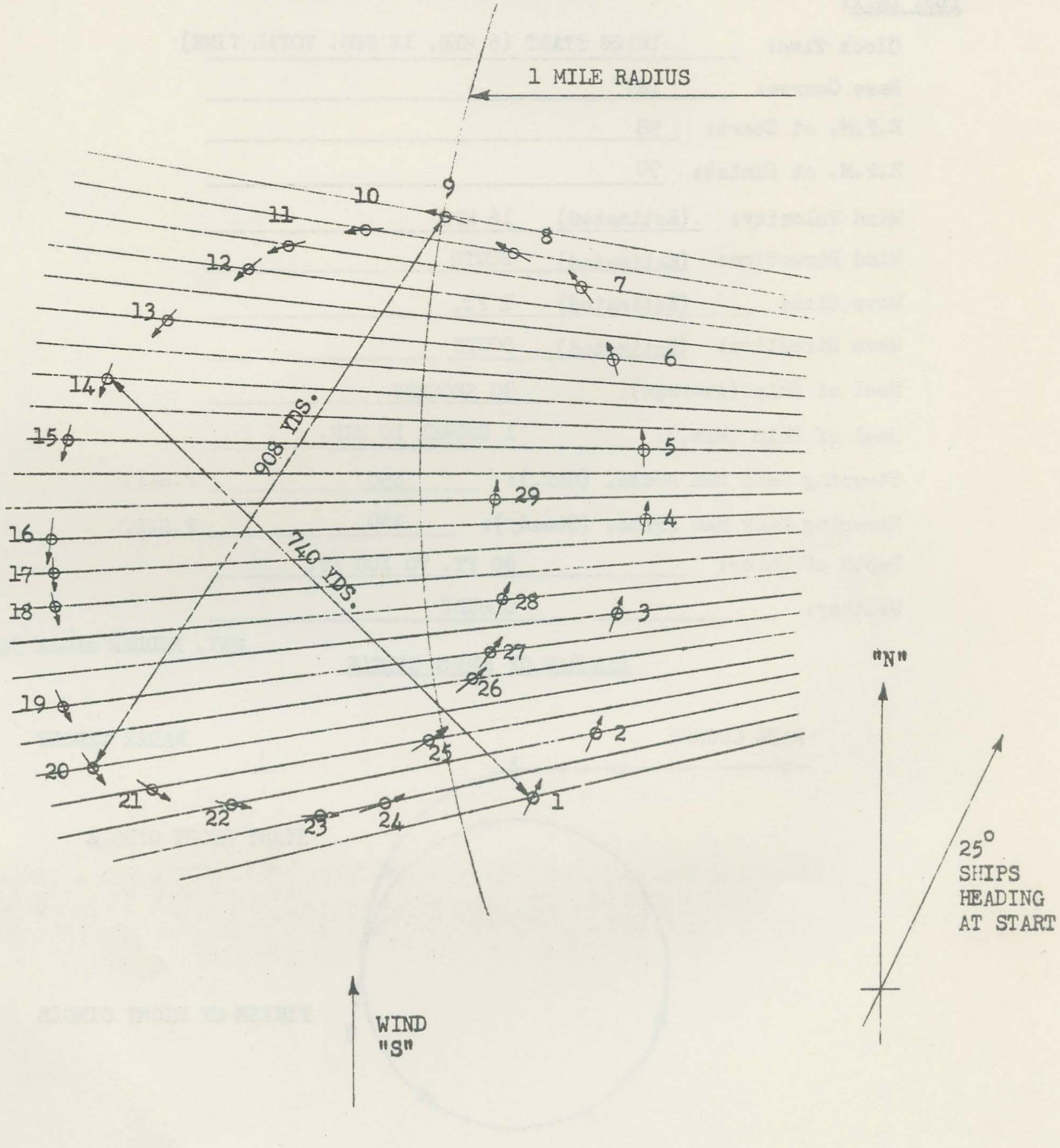


G.T.V. WILLIAM PATTERSON

SECTION: 5

DATE: 9-4-57

LEFT CIRCLE RADAR PLOT



SECTION: 5

DATE: 9-4-57

RIGHT CIRCLE TEST

TEST DATA:

Clock Time: 10:28 START (6 MIN. 12 SEC. TOTAL TIME)

Base Course: 187°

R.P.M. at Start: 98

R.P.M. at Finish: 90

Wind Velocity: (Estimated) 16 MPH

Wind Direction: (Estimated) SOUTH

Wave Size: (Estimated) 1 FT.

Wave Direction: (Estimated) SOUTH

Heel of Ship (Average): 30 SECONDS

Heel of Ship (Max.): 1 DEGREE 10 MIN.

Steering Gear Ram Press. (Max.): 550 P.S.I.

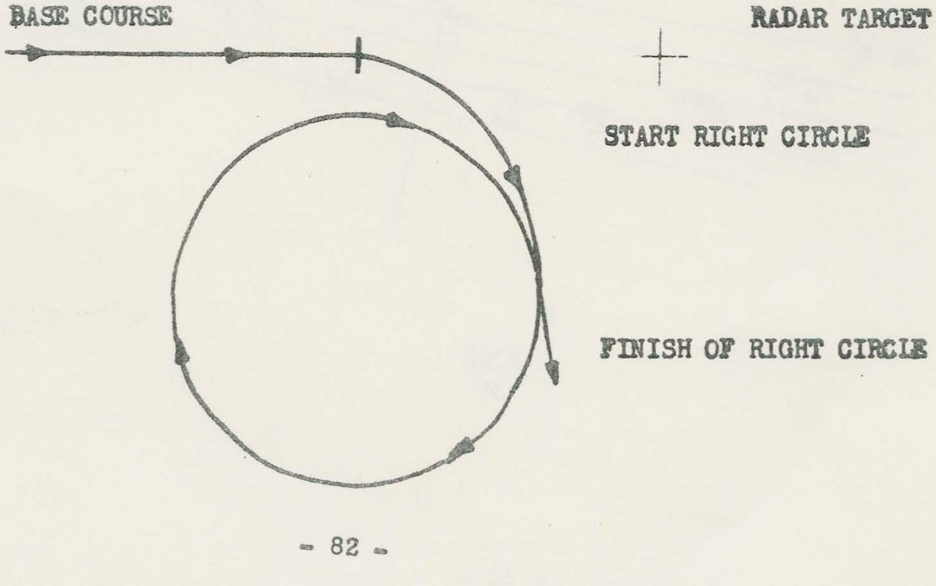
Steering Gear Ram Press. (Steady): 250 P.S.I.

Depth of Water: 80 FT. TO 100 FT.

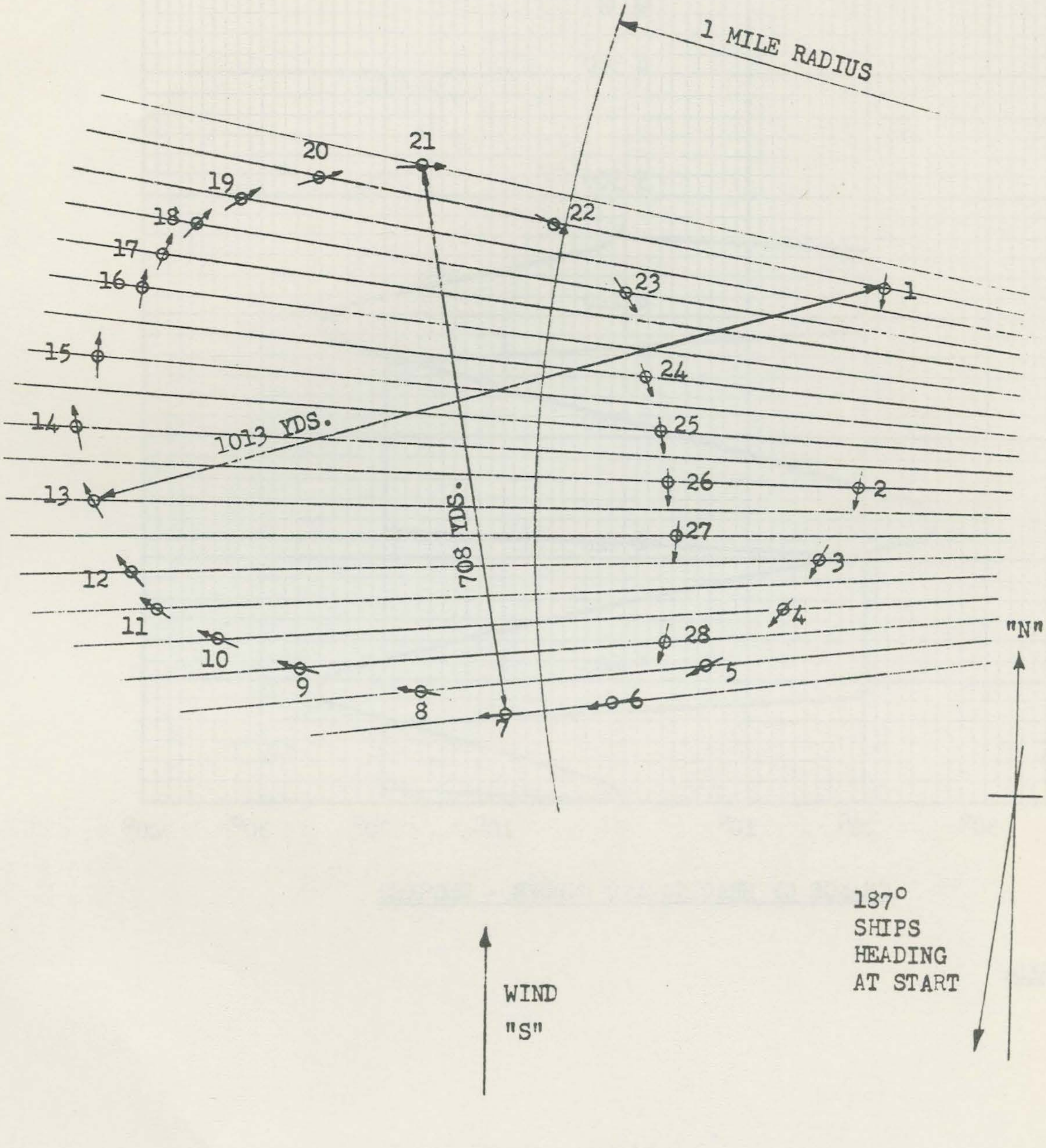
Weather: CLOUDY

MAX. RUDDER ANGLE 34°

DIAGRAM OF RIGHT CIRCLE



RIGHT CIRCLE RADAR PLOT

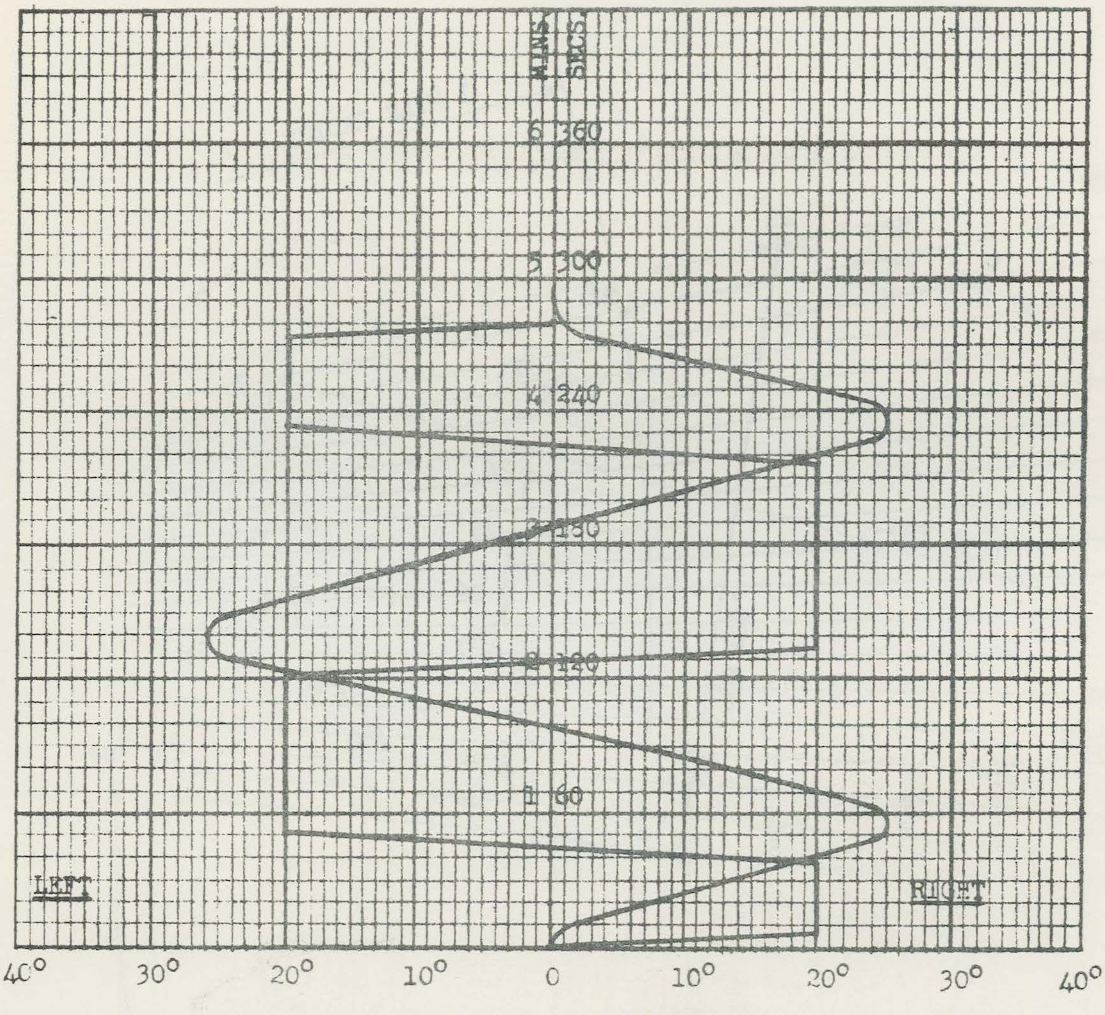


G.T.V. WILLIAM PATTERSON

DATE: 9-4-57
SECTION: 6

SEA TRIAL "Z" MANEUVER

"Z" - MANEUVER DATA SHEET



CHANGE OF HEADING AND RUDDER - DEGREES

REMARKS:

APPENDIX - G

Summary of Maneuvering and Anchor Tests

(a) Ahead Steering Test

(b) Astern Steering Test

(c) Emergency Steering Test

(d) Right Circle Test

(e) Left Circle Test

(f) "Z" Maneuver - From Wheelhouse
From Steering Gear Room

(g) Crash Astern (Head Reach)

(h) Crash Ahead (Astern Reach)

(i) Astern Run

(j) Test of Anchor Windlass (At Dock)

(k) Anchor Windlass Test - September 5, 1957

G.T.V. WILLIAM PATTERSON
Official Trials

AHEAD STEERING TEST

POWER UNIT	DIRECTION	TRAVEL DEGREES	MAX. STEADY OIL PRESS. P.S.I.G.	MOTOR VOLTS	MOTOR AMPS.	MOTOR R.P.M.	MAX. OIL PRESS. P.S.I.G.
PORT UNIT	Midship to H.O. Right	35	250	228	80	840	550
	H.O. Right to H.O. Left	70	250	228	66	850	800
	H.O. Left to H.O. Right	70	250	228	84	835	550
	H.O. Right to Midship	35	120	228	58	850	200
STBD. UNIT	Midship to H.O. Left	35	200	228	76	900	500
	H.O. Left to H.O. Right	69	250	228	82	915	550
	H.O. Right to H.O. Left	69	250	228	58	900	500
	H.O. Left to Midship	35	93	228	58	910	200

BASE COURSE - 140°

Record of time as rudder passed through the following degrees: 0°, 30°, 35°
(as rudder swings from 35° to 35°)

UNIT	RUDDER	0°	30°	35°
PORT	LEFT	9"	18"	22.5"
	RIGHT	10"	19"	23"
STBD.	LEFT	9"	18"	22"
	RIGHT	9"	16"	21"

SHAFT R.P.M.	Stbd.	Port
START	99	97
FINISH	95	93

DEPTH OF WATER - 63'

ELAPSED TIME:

Stbd. Unit 1':45"
Port Unit 1':55"
CLOCK TIME @ START 1254
CLOCK TIME @ FINISH 1257:55

G.T.V. WILLIAM PATTERSON
Official Trials

ASTERN STEERING TEST

POWER UNIT	DIRECTION	TRAVEL DEGREES	MAX. STEADY OIL PRESS. P.S.I.G.	VOLTS	MOTOR AMPS.	R.P.M.	MAX. OIL PRESS. P.S.I.G.
PORT UNIT *	Midship to H.O. Right						
	H.O. Right to H.O. Left		SEE NOTE BELOW				
	H.O. Left to Midship						
STBD. UNIT	Midship to H.O. Left	35	150	228	56	900	450
	H.O. Left to H.O. Right	70	150	228	56	900	450
	H.O. Right to H.O. Left	35	150	228	56	905	450

BASE COURSE - Vessel Swinging

Record of time as rudder passed through the following degrees:
(As rudder swings from 35° to 35°)

UNIT	RUDDER	0°	30°	35°
PORT	LEFT			
STBD.	RIGHT	15"	41"	57"

SHAFT R.P.M.

START - 66
FINISH - 66
DEPTH WATER - 46 Ft.
CLOCK TIME @ START - 0944
CLOCK TIME @ FINISH - 0946

NOTE:

Only one (1) power unit necessary as directed by M.A. Trial Board.

G.T.V. WILLIAM PATTERSON
Official Trials

EMERGENCY STEERING TEST

POWER UNIT	RAM	DIRECTION	TRAVEL DEGREES	MAX STEADY OIL PRESS. P.S.I.G.	MOTOR VOLTS	MOTOR AMPS.	MOTOR RPM	MAX. OIL PRES. P.S.I.G.
STBD	PORT ONLY	Midship to H.O. Right	15	110	228	20	880	250
		H.O. Right to H.O. Left	30	100	228	32	880	200
		H.O. Left to Midship	15	100	228	20	890	300
PORT	STBD. ONLY	Midship to H.O. Right	15	250	228	18	930	300
		H.O. Right to H.O. Left	30	100	228	38	920	250
		H.O. Left to Midship	15	100	228	18	925	200

BASE COURSE - Port - 173° Stbd. - 168°

Record of time as rudder passed through the following degrees:
(As rudder swings from 15° to 15°)

UNIT	RUDDER	0°	10°	15°
PORT	RIGHT	8"	15"	18"
	LEFT	34"	43"	45"
STBD.	RIGHT	8"	16"	19"
	LEFT	35"	43"	46"

CHANGEOVER (SEC.) 78"

SHAFT R.P.M.	Port	Stbd.
START	40	40
FINISH	40	40

DEPTH OF WATER: 45' - 50'
CLOCK TIME @ START - 1833
CLOCK TIME @ FINISH - 1839:28

ELAPSED TIME:

Port Unit - 1'-35"
Stbd.Unit - 1'-28"

G.T.V. WILLIAM PATTERSON
Official Trials

RIGHT CIRCLE TEST

Record change in heading, relative bearing of target and range of target at 16 second intervals.

ELAPSED TIME MIN:SEC	RELATIVE BEARING OF TARGET	RANGE OF TARGET (MILES)	SHIP HEADING	TRUE BEARING SHIP FROM TARGET
0:00	273	.8	187	280
0:16	256	.8	195	
0:32	240	.83	208	
0:48	223	.85	223	
1:04	206	.9	238	
1:20	190	.96	253	
1:36	176	1.02	267	
1:52	162	1.07	282	
2:08	148	1.15	297	
2:24	134	1.2	312	
2:40	121	1.23	326	
2:56	108	1.25	340	
3:12	95	1.27	355	
3:28	83	1.28	09	
3:44	71	1.27	23	
4:00	59	1.25	37	
4:16	46	1.24	51	
4:32	34	1.23	64	
4:48	20	1.2	79	
5:04	08	1.15	92	
5:20	357	1.09	104	
5:36	341	1.01	119	
5:52	325	.96	133	
6:08	307	.94	146	
6:24	293	.93	160	
6:40	278	.92	173	271
6:56	262	.91	187	269
7:12	245	.92	200	265

G.T.V. WILLIAM PATTERSON
Official Trials

LEFT CIRCLE TEST

Record change in heading, relative bearing of target and range of target at 16 second intervals.

ELAPSED TIME MIN:SEC	RELATIVE BEARING OF TARGET	RANGE OF TARGET (MILES)	SHIP HEADING	TRUE BEARING SHIP FROM TARGET
0:00	52	.95	25	257
0:16	58	.9	21	259
0:32	76	.875	08	264
0:48	95	.85	353	268
1:04	115	.85	336	271
1:20	134	.875	321	275
1:36	152	.9	306	278
1:52	168	.95	291	279
2:08	184	.99	276	280
2:24	197	1.05	262	279
2:40	209	1.1	249	278
2:56	224	1.12	233	277
3:12	236	1.17	219	275
3:28	248	1.22	205	273
3:44	260	1.24	191	271
4:00	272	1.25	176	268
4:16	285	1.25	162	267
4:32	298	1.25	148	266
4:48	310	1.25	133	263
5:04	322	1.24	119	261
5:20	338	1.2	102	260
5:36	351	1.15	88	259
5:52	04	1.1	74	258
6:08	20	1.05	58	258
6:24	35	1.01	45	260
6:40	51	.97	31	262
6:56	67	.96	16	263
7:12	83	.95	02	265
7:28	102	.95	347	269

G.T.V. WILLIAM PATTERSON
Official Trials

"Z" MANEUVER

Record change in heading at 10 second intervals:

FROM WHEELHOUSE

ELAPSED TIME MIN:SEC.	SHIP HEADING DEGREES	ELAPSED TIME MIN:SEC.	SHIP HEADING DEGREES	ELAPSED TIME MIN:SEC.	SHIP HEADING DEGREES
0:10	165	2:10	139	4:10	183
0:20	170	2:20	137	4:20	178
0:30	176	2:30	139	4:30	170
0:40	183	2:40	145	4:40	163
0:50	188	2:50	151	4:50	
1:00	187	3:00	158	5:60	
1:10	184	3:10	164	5:10	
1:20	177	3:20	170	5:20	
1:30	169	3:30	177	5:30	
1:40	161	3:40	183	5:40	
1:50	154	3:50	188	5:50	
2:00	146	14:00	188	6:00	

CLOCK TIME - 1310
BASE COURSE - 163°
DRAFTS:
FORWARD - 14'-0"
AFT - 22'-0"
DEPTH OF WATER - 60 Ft.
LOCALITY - Cove Point

R.P.M. @ START - 99
R.P.M. @ FINISH - 98 (Back on Base Course)

(ESTIMATED)
WIND VELOCITY: 12 - 15 MPH

DIRECTION: S.W.

WAVE SIZE: 1 Ft.

DIRECTION: S.W.

G.T.V. WILLIAM PATTERSON
Official Trials

"Z" MANEUVER

FROM STEERING GEAR ROOM

RUDDER ANGLE	ELAPSED TIME MIN:SEC.
Base Course	0:00
20° Right	0:07
Start Left	0:39
Midships	0:44
20° Left	0:50
Start Right	2:01
Midships	2:06
20° Right	2:15
Start Left	3:39
Midships	3:44
20° Left	3:51
Start Right	4:33
Base Court	4:40

G.T.V. WILLIAM PATTERSON
Official Trials

CRASH ASTERN (HEAD REACH)
September 6, 1957

TEST DATA:

Base Course: 30°
S.H.P. Ahead: 5900
R.P.M. Ahead: 98
Depth of Water: 210 Ft.
Wind Velocity (Estimated): 15 MPH
Wind Direction (Estimated): ENE
Wave Direction (Estimated): ENE
Wave Height (Estimated): 8"
Time of Full Astern Signal: 0925

NOTE: All times are to be taken from full astern signal.
Time to stop shaft (Stop watch in engine room): 13 Seconds
Time to reach normal Astern Shaft R.P.M. (Stop watch in engine room: 2'-6"
Time till ship judged dead in water (Stop watch on Bridge): 4'-4"

Float No.	Time	Distance Between Floats (Feet) Estimated
1	0'-8"	300
2	0'-21"	300
3	0'-32"	300
4	0'-47"	300
5	1'-3"	300
6	1'-19"	300
7	1'-37"	300
8	2'-0"	300
9	2'-26"	300
10	2'-57"	300
11	4'-4"	270
12		

Total Ahead Reach: 3,270 Feet

G.T.V. WILLIAM PATTERSON
Official Trials

CRASH AHEAD (ASTERN REACH)
September 6, 1957

TEST DATA:

Base Course: 0°
S.H.P. Astern: 1650
R.P.M. Astern: 60
Depth of Water: 210 Ft.
Wind Velocity (Estimated): 15 MPH
Wind Direction (Estimated): ENE
Wave Direction (Estimated): ENE
Wave Height (Estimated): 8"
Time of Full Ahead Signal: 1030

NOTE: All times are to be taken from full ahead signal.
Time to stop shaft (Stop watch in engine room): 4 Seconds
Time to reach normal ahead R.P.M. (Stop watch in engine room): 1'-14" (90 RPM)
Time till ship judged dead in water (Stop watch on Bridge): 58 Seconds

Float No.	Time	Distance Between Floats (Feet) Estimated
1	58"	280
2		
3		
4		
5		
6		

Total Astern Reach: 280 Feet

G.T.V. WILLIAM PATTERSON
Official Trials

ASTERN RUN
September 6, 1957

Clock Time 0925 @ start, 1030 @ finish

Wind Velocity (Estimated) Force 2-1/2

Wave Direction (Estimated) East

Wind Direction (Estimated) East

Wave Height (Estimated) Calm

Depth of Water 100 Ft.

G.T.V. WILLIAM PATTERSON
Official Trials

TEST OF ANCHOR WINDLASS (At Dock)
May 3, 1957

OPERATION	ANCHOR	PRESSURE PSIG	CHAIN SPEED FPM	EXHAUST PSI
Lowering	P	105	49.0	10
Hoisting	P	105	40.8	10
Lowering	P	105	51.8	10
Hoisting	P	105	42.2	10
Lowering	P	105	53.0	10
Hoisting	P	105	43.7	10
Lowering	S	105	50.0	10
Hoisting	S	105	45.0	10
Lowering	S	105	51.8	10
Hoisting	S	105	43.6	10
Lowering	S	105	53.0	10
Hoisting	S	105	45.0	10
Lowering	P & S	105	57.1	10
Hoisting	P & S	105	31.4	10
Lowering	P & S	105	55.4	10
Hoisting	P & S	105	31.4	10
Lowering	P & S	105	56.0	10
Hoisting	P & S	105	30.0	10

OPERATION:

Noise - Normal
Lubrication - Satisfactory
Vibration - Satisfactory
Alignment - Satisfactory

REMARKS:

Warping section of test was accomplished with a dynamometer, applying a static load of 13,000# to warping heads and holding for a period of five (5) minutes. Tested satisfactorily.

G.T.V. WILLIAM PATTERSON
Official Trials

ANCHOR WINDLASS TEST
September 5, 1957

ANCHOR	HOIST FATHOMS	HOISTING TIME MIN. SEC.	AVERAGE CHAIN SPEED	STEAM PRESS P.S.I.G.	EXH. PRESS. P.S.I.G.	R.P.M.
Port	60 to 45					
Port	45 to 30					
Port	30 to 15					
Stbd.	60 to 45					
Stbd.	45 to 30					
Stbd.	30 to 15					
Port & Stbd.	30 Fathoms to Water's Edge					

SIZE OF ANCHOR CHAIN: 2-1/16"

WEIGHT PER SHOT: 3,750#

DEPTH OF WATER: 7500 Feet

MECHANICAL BRAKE OPERATION: Satisfactory

WEIGHT OF ANCHOR: 8,400#

CLOCK TIME: START 2015 ; FINISH 2245

9-5-57

Chain speed while heaving anchors up individually (temporary repaired bearings), each anchor averaged between 25 Ft./Min. and 45 Ft./Min. as anchor was heaved in from 3 shots to the waters edge.

8-22-57

Builder's Bay Trial: Both anchors were heaved up together from 2 shots to the waters edge. Chain speeds averaging: 36 Ft./Min.; 42 Ft./Min.; 51 Ft./Min.; 54 Ft./Min.

APPENDIX - H

Special Equipment Installed For Trials

G.T.V. WILLIAM PATTERSON
Official Trials

SPECIAL EQUIPMENT INSTALLED FOR TRIALS

FUEL METERS

The sixteen (16) meters used for measuring fuel during the trials were obtained from the U. S. Naval Engineering Experiment Station by the Maritime Administration. These meters were installed as follows:

Bunker "C" Fuel Meters

Size	Location
1-1/4"	Two (2) in series in discharge line to gasifiers
1-1/4"	Two (2) in series in return line from gasifiers to fuel oil service tank.
1-1/4"	Two (2) in series in suction line to boiler fuel pumps
1/2"	Two (2) in series in return line from boiler fuel pumps to fuel oil service tank.
1-1/4"	One (1) in recirculating return line.

Diesel Fuel Meters

1-1/4"	Two (2) in series in discharge line to gasifiers
1-1/4"	Two (2) in series in return line to 1200 gallon diesel oil day tank.
3/4"	Two (2) in series in line to diesel generators
1-1/4"	One (1) in recirculating return line

TORSIONMETER

The torsionmeter used for the trials was furnished by the David Taylor Model Basin and utilizes their Mark II Magnetic Micrometer.

Torsionmeter zeros could not be obtained by the usual shaft drag because turbine windage imposed a load which would not let the shaft drag freely. Zeros were determined by jacking the shaft with the jacking gear before and after trials.

THRUSTMETER

A thrustmeter, furnished by the David Taylor Model Basin, was installed in place of the main thrust bearing cage located forward of the bull gear. Load is taken on four hydraulic pressure cells with a total effective area of 100 square inches so that thrust equals hydraulic pressure times 100.

The size of the meter is 26½" and was manufactured by the Kingsbury Machine Works, Inc., Philadelphia, Pennsylvania.

The hydraulic pressure developed in the pressure cells was read on bourdon type pressure gage.

SHAFT REVOLUTION COUNTERS

A pair of Veeder-Root magnetically operated counters were furnished by the David Taylor Model Basin.

VELOMETER

Velometers with a 30" pilot tube was used for measuring the exhaust from the gas turbines. The readings were taken in the exhaust trunks at the boat deck level.

MANOMETERS

There were two (2) manometers for measuring the exhaust pressures:

(a) One (1) 120" for measuring the six (6) gasifier exhaust pressures and turbine inlet gas pressures.

(b) One (1) 36" for measuring the two (2) turbine exhaust Pressures.

APPENDIX - I

Capacity Tables

CAPACITY TABLES

Tonnages

Gross Tonnage	U.S.	7,275.25
Net Tonnage	U.S.	4,518
Gross Tonnage	Panama Canal	7,382.91
Net Tonnage	Panama Canal	5,151.60
Gross Tonnage	Suez Canal	7,424.64
Net Tonnage	Suez Canal	5,667.34
Official Number		241,879
Radio call		KFVC

NOTE: Capacities of fuel oil and diesel oil tank are 98% of net volume after deduction of volume occupied by structure, piping, drain wells, and other obstructions. Capacities of Fresh Water and ballast tanks are 100% of similar net volumes.

Allowance for fixed ballast has been made in cargo capacities of No. 2 and No. 4 holds.

Grain capacity is the moulded volume of cargo holds plus volume in square of hatch up to underside of hatch cover beams, less the physical volume occupies by structural members, battens, piping and other obstructions.

Bale capacity is calculated to inside surfaces of battens, ceilings, underside of deck beams, etc., plus volume in square of hatch up to underside of hatch cover beams, with deductions from volumes so obtained for deck girders, ladders, piping and other obstructions.

Net capacity of refrigerated spaces is calculated to inside surfaces of sheathing mastic and battens.

Capacities of stores spaces exclude volume of passageways, door openings and shelving as applicable.

Centers of gravity of cargo holds are based on bale capacities.

CAPACITIES

CARGO

COMPARTMENT	Frame No.	Grain Cap.	Bale Cap.	V.C.G.	L.C.G. Aft F.P.
Hold No. 1					
Hold	12 - 39	65,074	56,913	16.41	80.9
Tween-Decks	4 - 39	44,985	41,050	35.61	75.1
Hold No. 2					
Hold	39 - 68	88,221	81,313	17.37	145.1
Tween-Decks	39 - 68	46,744	42,630	34.02	143.5
Hold No. 3					
Hold	68 - 88	28,020	24,473	23.09	206.1
Tween-Decks	68 - 88	24,387	19,993	32.76	202.7
Hold No. 4					
Hold	116 - 134	54,569	48,037	18.22	323.0
Tween-Decks	111 - 134	35,277	29,689	33.81	315.6
Hold No. 5					
Hold	134 - 162	58,620	51,571	19.52	374.6
Tween-Decks	134 - 162	34,570	30,864	35.18	379.4
Deep Tank No. 2	68 - 88	38,631	35,215	10.81	206.1
Deep Tank No. 3 Port	108 - 116	13,699	12,534	16.24	291.1
Deep Tank No. 3 Stbd.	108 - 116	13,188	12,024	16.48	291.1
TOTAL		545,985	486,306		

WATER BALLAST
(Tanks 100% Full)

TANK	Frame No.	Cu.Ft.	Tons	V.C.G.	L.C.G. Aft F.P.
Wash Water - Fore Peak	Stem 4	5,511	153	16.59	20.15
Water Ballast-No.1 S.W.	12-39	5,307	152	2.07	86.1
No.2 P.S.W.	39-68	5,967	170	1.92	146.1
No.2 S.S.W.	39-68	5,924	169	1.92	146.1
Fixed W.Ballast-No.4A P.F.W.	88-96	1,116	31	2.00	240.0
No.4A S.F.W.	88-96	1,116	31	2.00	240.0
Water Ballast-No.5 P.S.W.	108-134	4,391	125	1.90	310.9
No.5 S.S.W.	108-134	4,391	125	1.90	310.9
No.6 - S.W.	134-162	4,116	118	1.95	372.4
Wash Water - After Peak	162-174	5,438	151	27.10	425.6
Deep Tank - No. 1 S.W.	4-12	8,576	245	15.47	40.6
No. 2 S.W.	68-88	42,220	1206	11.95	206.1
No. 3 P.S.W.	108-116	13,502	386	16.82	291.1
No. 3 S.S.W.	108-116	13,065	373	16.92	291.1
	TOTAL	120,640	3,435		

FRESH WATER

TANK	Frame No.	Gals.	Tons @ 36 Cu.Ft.	V.C.G.	L.C.G. Aft F.P.
Feed W. Tank-No.4B P.F.W.	96-107	2,041	57	2.00	264.6
Feed W. Tank-No.4B S.F.W.	96-107	2,041	57	2.00	264.6
Fresh Water P	108-113	7,541	28	34.55	287.3
Fresh Water S	108-113	7,541	28	34.55	287.3
	TOTAL	19,164	170		

HEAVY FUEL OIL
(Tanks 98% Full)

TANK	Frame No.	Gal.	Tons @ 37.23 C.F.	V.C.G.	L.C.G. Aft F.P.
Heavy Fuel Oil-No.1	12-39	38,901	140	2.07	86.1
" " " No.2 P	39-68	43,750	157	1.92	146.1
" " " No.2 S	39-68	43,420	156	1.92	146.1
" " " No.5 P.	108-134	32,180	116	1.90	310.9
" " " No.5 S	108-134	32,180	116	1.90	310.9
" " " No. 6	134-162	30,200	108	1.95	372.4
F.O. Settling Tank P.	88-96	13,800	50	12.5	241.0
" " " S.	88-96	13,800	50	12.5	241.0
Deep Tank - No. 3 P.	108-116	98,981	355	16.82	291.1
" " No. 3 S.	108-116	95,790	344	16.92	291.1
TOTAL		443,002	1,592		

LIGHT FUEL OIL
(Tanks 98% Full)

TANK	Frame No.	Gal.	Tons @ 41.5 C.F.	V.C.G.	L.C.G. Aft F.P.
Diesel Oil Tank-No.3 P	68-88	32,260	104	1.90	205.9
" " " No.3 S	68-88	32,260	104	1.90	205.9
TOTAL		64,520	208		

STORES

STORE ROOM		Frame No.	Cu.Ft.	V.C.G.	L.C.G. Aft F.P.
Stores	2nd Deck	Stem - 4	2,425	33.25	19.7
Bos'ns Stores	37 Ft. Flat	Stem - 1	3,667	43.29	15.4
Dry Stores	2nd Deck	88 - 97	2,735	32.9	241.8
REFRIGERATED STORES					
Meat		94 - 100	801	33.12	253.6
Fish		97 - 100	173	32.89	257.5
Vegetables		88 - 94	768	33.13	258.6
Dairy		88 - 91	176	33.12	234.8
Tween Deck Refr. Stores	(Stbd)	82 - 88	648	33.54	223.3
" " " "	(Port)	82 - 88	1,053	33.54	223.6
		TOTAL	12,446		

FIXED SOLID BALLAST

COMPARTMENT	Frame No.	Tons.	V.C.G.	L.C.G. Aft F.P.
Hold No. 2	39 - 68	687	4.99	145.8
Hold No. 4	116 - 134	320	4.79	321.6
	TOTAL	1,002		

APPENDIX - J

Fuel Oil and Lube Oil Analyses

NBS 259 (Rev. 3/1/50)

UNITED STATES DEPARTMENT OF COMMERCE
WASHINGTON

National Bureau of Standards

Report

of Tests of Samples of

Fuel Oil and Water

Submitted by

Maritime Administration
Washington 25, D.C.

Analytical and specifications tests were performed on two samples of fuel oil and on two samples of water in accordance with a request dated September 19 from the Division of Engineering, Office of Ship Construction, Maritime Administration. The samples identified as No. 2439, Fuel Oil; No. 2440, Fuel Oil, diesel; No. 2442, Water, Fresh, Cooling, with chromate inhibitor; and No. 2444, Water, Salt, intake, are reportedly from a trial run of the GTV WILLIAM PATTERSON.

The total heats of combustion at constant volume were determined by the Thermodynamics Section in a bomb calorimeter. The net heat of combustion at constant pressure was calculated by means of the relation

$$Q_p \text{ (net)} = 4310 + 0.7195\, Q_v \text{ (gross)}$$

The results obtained on these and the standard specification tests are as follows:

Sample Number	2439	2440	2442	2444
Heat of Combustion, gross BTU/lb.	18335	19605	-	-
Heat of Combustion, net BTU/lb.	17500	18415	-	-
Analysis, Carbon, %	85.9	-	-	-
Hydrogen, %	11.0	-	-	-
Sulfur, %	2.55	-	-	-
Viscosity, SF at 122°F, seconds	140.4	-	-	-
Water by distillation, vol. %	0.15	-	-	-
Sediment by extraction, wt. %	0.08	-	-	-
Ash, by weight, %	0.11	-	-	-

G-22534
352-6-57
10-15-57

Sample Number	2439	2440	2442	2444
Gravity, °A.P.I.	13.6	-	-	-
Specific Gravity*				
60/60°F	0.9752	0.8393	1.004	1.027
110/60°F	.9579	.8207	-	-
120/60°F	.9545	.8170	-	-
130/60°F	.9510	.8133	-	-
140/60°F	.9477	.8096	-	-
Flash Point, PMCC, °F	172	-	-	-
Specific Heat, Cal/g./°C (23.6°C)	-	0.4608	0.9946	0.9586

*Calculated

FOR THE DIRECTOR

NATIONAL BUREAU OF STANDARDS

Thomas W. Mears
for
Frank L. Howard, Chief
Engine Fuels Section

G-22534
352-6-57
10-15-57

Sheet 2 of 2 sheets

A

U. S. NAVAL ENGINEERING EXPERIMENT STATION
Annapolis, Maryland

IN REPLY REFER TO:
NP/L5/J5(714A)
Test 070469B

21 OCT 1957

From: Commanding Officer and Director
To: Chief, Division of Engineering, Office of Ship Construction, Maritime Administration, Department of Commerce, Washington 25, D. C.

Subj: Test of two lubricating oils from the GTV WILLIAM PATTERSON; Evaluation Report 070469B

Ref: (a) Maritime Administration ltr EE10-3/S8/MCE 48:831.1 FH, QM 272.1 of 20 Sept 1957
(b) Thermal Properties of Petroleum Products, BUSTDS Misc. Pub. No. 97 of 9 Nov 1929

1. This Station was requested in reference (a) to determine the specific gravity and specific heat of two lubricating oils from the GTV WILLIAM PATTERSON. Two 1-quart samples were received on 23 September 1957.

2. The specific gravity of the samples was measured at 60°/60°F. The specific heat of the oils was measured at 80°F and calculated at several temperatures by the formula given in reference (b). The results are shown below.

Sample marked	Sample No. 2441, Piston Coolant	Sample No. 2443 From Purifier
EES Sample No.	B-5062	B-5063
Specific gravity, 60°/60°F	0.904	0.904
Specific heat,		
determined at 80°F	0.444	0.450
calculated at 80°F	0.446	0.446
100°F	0.455	0.455
200°F	0.503	0.503

W. W. BROWN

J. R. Belt

J. R. BELT
Superintendent
Fuels & Lubricants Project
By direction

Copy to:
BUSHIPS

APPENDIX - K

Floodable Length Curve

G.T.V. WM. PATTERSON

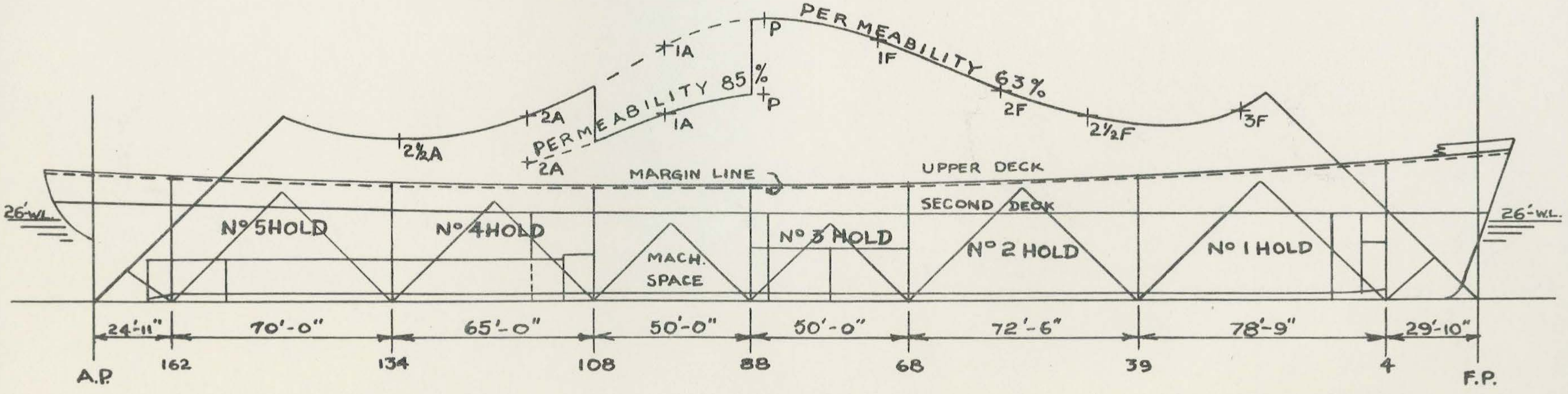
PERMEABILITIES

MACHINE SPACE	85 %
ELSEWHERE	63%

PRINCIPAL DIMENSIONS

L.O.A.	467'-2 15/16"
L.B.P.	441'-0"
BEAM MOLDED	56'-10¾"
BEAM EXTREME	57'-1½"
DEPTH MOLDED TO UPPER DECK	37'-4"
DEPTH MOLDED TO 2ND DECK	28'-7"
DRAFT FULL LOAD, KEEL	26'-7"
SUBDIVISION DRAFT	26'-0"

FLOODABLE LENGTH CURVES



MCE HULL 48

APPENDIX - L

Stability Test Data

Form NCG 996
(SHEET 1)
UNITED STATES COAST GUARD

UNITED STATES COAST GUARD

STABILITY TEST DATA

APPROVED
FOR VESSELS COVERED & SUBJECT
TO COMMENTS IN LETTER OF
SEP 6 1957
UNITED STATES COAST GUARD
MERCHANT MARINE TECHNICAL DIV.
By direction of the Commandant

GT/V WM PATTERSON

OFFICIAL No. 241879

Gross tons 7275

Description of vessel SINGLE SCREW CARGO VESSEL
Type EC2 - G - 8g
Builder BETHLEHEM-FAIRFIELD SHIPYARD INC.
Hull No. 2035 Date Built 1942
Hull LENGTHENED LIBERTY TYPE

Machinery FREE PISTON GAS TURBINE

Classed by A.B.S. Inspected ☐ Safety certificate ☐ Load line ☐
Route: Ocean ☒ Coastwise ☐ Great Lakes ☐ Bays ☐ Rivers ☐
Specify route, if limited

Owner U.S. MARITIME ADMINISTRATION
Owner's address WASHINGTON, D.C.

Vessel inclined at BETHLEHEM STEEL CO. - BALTIMORE YARD
Date 17 APRIL 1957 Time 7:00 P.M.
Test requested by U.S. MAR AD

Plans furnished by BETHLEHEM STEEL CO.
Offsets measured by " " "
Curves of form computed by " " "

Test conducted by BETHLEHEM STEEL CO.
Stability calculations made by " " "

Duplicate vessels
SUBMITTED: 16 MAY 1957

STABILITY TEST S.T/V WM PATTERSON

PRINCIPAL DIMENSIONS

Length over all 467 feet 2 15/16 inches (467.24 feet).

Length between perpendiculars which are at the extremities of ...... water line 441 feet 0 inches (441.00 feet).

Length between draft marks, condition AS INCLINED 418 feet 2 7/8 inches (418.24 feet).

Breadth, extreme, at 37 feet 4 inches above base 57 feet 0 5/32 inches (57.01 feet).

Breadth, molded, ⨯ at 37 feet 4 inches above base 56 feet 10 3/4 inches (56.90 feet).

Breadth at load water line MLD 56 feet 10 3/4 inches (56.90 feet).

Depth amidships, from BASE LINE to UPPER DK (MLD) 37 feet 4 inches (37.33 feet).

Apparent full-load mean draft for stability { molded base 26 feet 0 inches (26.00 feet).

Apparent full-load mean draft for stability { bottom of keel 26 feet 1 1/2 inches (26.13 feet).

Displacement, sea water, long tons (2,240 lb.), at above full-load draft 13,570 tons.

Freeboard amidships at above full-load draft 11 feet 4 inches (11.33 feet).

Freeboard at low point of sheer (...... ~~feet aft of~~ ⨯) 11 feet 4 inches (11.33 feet).

Location of ports, in hull, which may affect stability ......

GENERAL INFORMATION

Names and duties of official observers: MR J.B. ROBERTSON, U.S.C.G.; LCDR W.J. DAVIES, U.S.C.G.

Designers represented by: ......

Builders represented by: MR J.F. DOUTY; MR J.N. SHRADER

Owners represented by: MR. E. KADGAS, U.S. MARITIME ADMINISTRATION

Weather, tide, and mooring conditions: WEATHER: OVERCAST, SEA CALM, ALL LINES SLACK

Condition of ship as to completeness and as to water in boilers, machinery, and bilges (see note at bottom of sheet 5): VESSEL COMPLETE WITH EXCEPTION OF SPARE PARTS & MISC. STORES

NCG 983
(SHEET 8)
UNITED STATES COAST GUARD
(December 1942)

12-A

STABILITY TEST GT/V WM. PATTERSON

SHIP IN CONDITION LIGHTSHIP WITH PERMANENT BALLAST

DESCRIPTION OF CONDITION	ITEMS	DISPLACEMENT AND WEIGHT	C. G. ABOVE BASE		C. G. FROM M. P.			
		Tons	LEVER	VERTICAL MOMENTS Ft.-tons	FEET AFT	AFTER MOMENTS Ft.-tons	FEET FOR'D	FORWARD MOMENTS Ft.-tons
BALLAST, GROUT,	Ship in condition LIGHTSHIP WITHOUT BALLAST	3718.15	24.87	92,474.14	12.06	44830.60		
CRIBBING, GRATING	FIXED BALLAST HOLD #2	682.00	4.99	3403.18			74.74	50972.68
AS FINALLY INSTALLED	" " " #4	320.00	4.79	1532.80	101.10	32,352.00		
	CRIBBING IN " #2	3.65	5.10	18.62			73.42	267.77
	" " " #4	0.70	4.81	3.37	121.88	85.35		
	GRATING IN " #2	3.00	5.66	16.98			71.92	215.76
	" " #4	0.25	5.26	1.47	123.08	34.46		
Slack tanks NONE	FIXED WATER BALLAST - Nº 4 A D.B.	62.00	2.00	124.00	19.50	1209.00		
	TOTAL LIGHT SHIP WITH BALLAST	4789.78	2037	97,574.56	5.65	2705520		

~~Molded~~ Keel draft at longitudinal center of flotation corresponding to the above displacement for SALT water 10.40 feet.

Transverse metacenter above base at L. C. F. draft, uncorrected for trim 30.05 feet.

Transverse metacenter above base corrected for trim .... feet.

C. G. above base 20.37 feet.

Metacentric height, uncorrected for free surface {~~corrected for trim~~ / uncorrected for trim} G. M. 9.68 feet.

Correction for free surface. NONE ~~Metacentric height, corrected for free surface~~ {~~corrected for trim~~ / ~~uncorrected for trim~~} G. M. .... feet.

Longitudinal metacenter above C. G. at L. C. F. draft .... feet.

Moment to alter trim 1 foot at L. C. F. draft, 2 s $\frac{\text{Longl. GM} \times \Delta}{\text{I.}}$ CURVES FORM. 11,484 ft.-tons.

C. B. of ship on even keel at L. C. F. draft, ~~aft,~~ forward of ⊗ 3.23 feet.

C. G., aft, ~~forward~~ of ⊗ 5.65 feet.

Trimming lever 8.88 feet.

Trim, aft, ~~forward~~, 2 s $\frac{\text{Displacement} \times \text{Lever}}{\text{Moment to Trim}}$ 3.70 feet.

Longitudinal center of flotation, ~~aft,~~ forward of ⊗ 2.92 feet.

Difference between L. C. F. and ⊗ draft 0.02 feet.

Molded draft amidships 10.30 feet.

Draft on draft marks, forward 8 feet 7 3/4 inches.

Draft on draft marks, aft 12 feet 1 3/4 inches.

APPENDIX - M

Builder's Certificate of Deadweight

Form MA-223 E
(5-15-52)

U.S. DEPARTMENT OF COMMERCE
MARITIME ADMINISTRATION

CALCULATION OF DEADWEIGHT

	TONS
Total Displacement at Time Drafts Read	5432.00
Weight to be Deducted	713.13
Weight to be Added	70.91
Light Ship Weight	4789.78
Full Load Draft	26'-7"
Corresponding Displacement	13825.00
Light Ship Weight	4789.78
Deadweight	9035.22

BUILDER'S CERTIFICATION OF DEADWEIGHT

This is to Certify that the foregoing is an accurate determination of Deadweight for the XXX. GT/V WILLIAM PATTERSON and to the best of our knowledge is correct.

By: Seymour
Signature

Naval Architect
Title

Aug 26, 1957
Date of signature

Yard:

Approved: Vito L. Russo
Signature (Maritime Administration)

Chief, Division of ~~[illegible]~~ Ship Design
Title

9/6/57
Date of signature

Comm-DC 25409

APPENDIX - N

Temporary Certificate of Inspection

[illegible]

FILE NO. {T V 241879

CG 854
(Rev. 1-50)

UNITED STATES OF AMERICA
TREASURY DEPARTMENT
UNITED STATES COAST GUARD

The Certificate expires:
13 September 1959.

TEMPORARY CERTIFICATE OF INSPECTION

NAME OF VESSEL: G.T.V. "WILLIAM PATTERSON" OFF. No. 241,879

The undersigned, Officer in Charge Marine Inspection at the Port of Baltimore in the State of Maryland, hereby CERTIFIES that the Freight (Passenger, freight, etc.) Gas Turbine (Steam or motor) vessel, named G.T.V. "WILLIAM PATTERSON" of 7275 gross tons, of Baltimore, in the State of Maryland, whereof U.S.A., rep. by Department of Commerce, U.S. Maritime Administration is owner and James Macdonald is master, was regularly inspected on the 13th day of September, 19 57, by inspectors of the Coast Guard, and found to conform in all things with the applicable vessel inspection laws and the rules and regulations prescribed thereunder.

This Temporary Certificate of Inspection is issued under the provisions of Section 4421, Revised Statutes of the United States, in lieu of the regular certificate of inspection, and shall be in force only until the receipt on board said vessel of the original certificate of inspection, this certificate in no case to be valid after one year from the date of inspection. Maximum steam pressure allowed --- p. s. i.

The said vessel is permitted to navigate the waters of the OCEANS

This temporary certificate must be framed under glass; and, during the period of its validity, must be conspicuously placed on the vessel where it will be most likely to be observed by passengers and others.

PERSONS ALLOWED TO BE CARRIED

Officers and crew	44
Persons in addition to crew	12
Passengers (regular)	-
Passengers (excursion)	-
Total number allowed	56

[illegible] H. McCABE, Commander, U. S. Coast Guard
Officer in Charge Marine Inspection.

TREASURY DEPARTMENT U. S. COAST GUARD CG-858 (Rev. 11-55)	CERTIFICATE OF INSPECTION AMENDMENT

NAME OF VESSEL G.T.V. WILLIAM PATTERSON	OFFICIAL NUMBER 241,879

CLASS Freight	GROSS TONS 7275	HOME PORT Baltimore, Maryland

WHEN AND WHERE BUILT

1942 - Baltimore, Maryland

CURRENT CERTIFICATE EXPIRES 13 September 1959	DATE AND PLACE CURRENT CERTIFICATE ISSUED 13 September 1957, Baltimore, Md.

This certifies that the following amendments to the certificate of inspection or examination issued to the vessel described above are authorized, namely:

This Amendment is valid for one voyage from Baltimore, Maryland, to New York, New York, commencing on or about 14 September 1957.

During this voyage, this vessel is permitted to carry 18 persons (observers and technicians) "in addition to the crew". Thus, the total persons allowed on board during this voyage is 62.

Required to carry 62 life preservers.

To be framed, under
glass, and posted near
Certificate of Inspection

PORT Baltimore, Maryland	DATE OF ISSUE 13 September 1957
INSPECTION ZONE Baltimore, Maryland	OFFICER IN CHARGE, MARINE INSPECTION F. H. McCABE, Commander, U. S. Coast Guard

INSTRUCTIONS

1. This certificate shall be issued only to authorize changes to the conditions or particulars entered on a current valid certificate of inspection or examination.
2. The original of this certificate will be delivered to the master or owner of the vessel named herein, which certificate must be framed under glass and posted on board near the certificate of inspection or examination, if the certificate of inspection or examination is required to be posted; or kept on board with the original certificate of inspection or examination, if the certificate of inspection or examination is not required to be posted, to be shown on demand.
3. One copy of this certificate will be delivered to the chief officer of customs of the district in which the copy of the original certificate of inspection or examination was filed.
4. One copy of this certificate will be filed with the copy of the certificate of inspection or examination that it amends in the office of the Officer in Charge, Marine Inspection.
5. Any additional equipment required must be stated herein.

PREVIOUS EDITIONS MAY BE USED

APPENDIX - O

Certificate of Admeasurement

Customs Form 1414
TREASURY DEPARTMENT
2.12, 3.48, 3.47, C. R. 1943
December 1943

Certificate No.

COPY

THE UNITED STATES OF AMERICA

TREASURY DEPARTMENT—BUREAU OF CUSTOMS

Port of Baltimore, Maryland

April 15 th , *19*57

CERTIFICATE OF RE/ADMEASUREMENT

I CERTIFY that an admeasurement has been made of the [1] oil screw

called the WILLIAM PATTERSON of Baltimore, Md. , official number 241879

which was built by Bethlehem Fairfield Shipyard, Inc. in the year 1942, at Baltimore,

State of Maryland, of Steel ; and has been known as builder's hull No.

that she has two deck s, three mast

Raked stem, and Elliptical stern;

that her register length is 448.7 /10 feet, her register breadth is 57.1 /10 feet

her register depth is 34.8 /10 feet, her height under upper deck is [2] /10 feet,

and that her tonnage is as follows:

	TONS	100THS
Capacity under tonnage deck [3] including F.P.T. 42.14; A.P.T. 45.95	6758	87
Capacity between decks above tonnage deck		
Capacity of enclosures on the upper deck, viz:		
Forecastle [4] , bridge , poop , break		
deckhouses 397.12, side houses , chart house		
radio house , excess hatchways 52.79, light and air [5] 66.47	516	38
GROSS TONNAGE	7275	25
Deductions under Section 4153, Revised Statutes, as amended (Section 77, title 46, United States Code):		
Crew space 301.31, master's cabin 18.63, steering gear 88.09		
anchor gear 18.90, boatswain's stores 72.75, chart house 6.60		
donkey engine and boiler , radio house 5.94		
storage of sails , propelling power (actual space [6] 912.00 (32/13 of Act. = 2244.92)		
TOTAL DEDUCTIONS	2757	14
NET TONNAGE	4518	

The following-described spaces, and no others, have been omitted, viz:

Forepeak , afterpeak , other spaces (except double bottoms) for water ballast 72.29; open forecastle , open bridge , open poop , open shelter deck , cabins [7] 37.73 companions 8.17, galley 16.88, skylights [8] 4.32, wheelhouse 26.23, water-closets 18.72; anchor gear , condenser , donkey engine and boiler , steering gear , light and air spaces [9] , other machinery spaces 2.28, [10] Ceiling in holds 3.63

S. C. Livingston
S.C.Livingston, *Admeasurer.*

(SEAL)

Deputy Collector of Customs.

I agree to the above description and admeasurement.

Owner, Master, or Agent.

---

[1] Insert "American steam screw," "British ship," or as case may be.
[2] Register height of uppermost deck to hull above tonnage deck.
[3] Name and give tonnage of each peak tank used other than for water ballast, which is included herein.
[4] Carry total of all enclosures to space at end of third line.
[5] These spaces are to be added to tonnage only by permission of the Commissioner of Customs.
[6] Insert in parenthesis the tonnage representing actual machinery space used in ascertaining propelling power deductions.
[7] *To be exempted*, cabins and staterooms for passengers must be on a deck which is not a deck to the hull; all other spaces except forepeak, afterpeak, and other water-ballast spaces must be *on* or *above* the upper deck to the hull. Give tonnage of each space. A cellular double bottom is not included in tonnage (2.28 C. R. 1943).
[8] Skylights and air shafts *not over* propelling machinery should be included in this item.
[9] Over propelling machinery, including skylights.
[10] Insert description and tonnage of any other space or spaces omitted.

APPENDIX - P

Provisional Load Line Certificate

FORM LL 5B 10M 5-49

AMERICAN BUREAU OF SHIPPING

APPOINTED BY THE COMMANDANT, U. S. COAST GUARD TO ASSIGN LOAD LINES, UNDER
THE PROVISIONS OF THE ACTS OF MARCH 2, 1929, AND
AUGUST 27, 1935.

PROVISIONAL LOAD LINE CERTIFICATE

Port Baltimore, Maryland **Date** September 13, 1957

This is to Certify ***that the Load Line markings, assigned under the provisions of the Load Line Regulations, for the*** G.T.S. "WILLIAM PATTERSON" of Baltimore, Md., ***Official No.*** 241,879 ***and which have been recommended to the Committee of this Bureau to approve, are as follows:***

Center of Disc below top of Steel Upper **deck** 10' - 11-1/4"

Maximum Load Line in tropical fresh water, above center of disc 1' - 1-3/4"

“ “ “ “ **fresh water,** “ “ “ “ - 7"

“ “ “ “ **tropical zones,** “ “ “ “ - 6-3/4"

“ “ “ “ **Summer, the center of disc** - -

“ “ “ “ **Winter, below** “ “ “ - 6-3/4"

“ “ “ “ **Winter, North Atlantic,** “ “ “ “ - -

This certificate is granted pending issuance of the permanent load line certificate, and is valid until March 13, 1958.

R. F. English
R. F. ENGLISH ***Surveyor.***

APPENDIX - Q

Master Carpenter's Certificate

MASTER CARPENTER'S CERTIFICATE

(BUILDER'S CERTIFICATE)

(R. S. 4147, R. S. 4312; 46 U. S. C. 34, 103—46 C. F. R. 1.34)

TREASURY DEPARTMENT

BUREAU OF CUSTOMS

District of Baltimore

[PLACE] Baltimore, Maryland

June 4, 1942

I, T. S. McElroy - Manager, (Write "master" or "principal") of Bethlehem-Fairfield Shipyard, Inc., do certify that

the [1] Steam Screw

called the [2] WILLIAM PATTERSON (Write the name exactly as painted or otherwise marked on the vessel), hull No. 2035

was built by Bethlehem-Fairfield Shipyard, Inc. (Write "by me", "under my direction", or "by ——", giving firm or corporate name, if built by firm or corporation)

during the year 1942 (Insert the year of completion)

at Baltimore (Write the name of the city or village at or nearest to which vessel was built)

State of Maryland

of Steel (Write "wood", "iron", "steel", or as the case may be)

for UNITED STATES OF AMERICA represented

by UNITED STATES MARITIME COMMISSION

that said Steam Screw has two

decks, three masts, a raked stem, and a cruiser-elliptical stern,

is 423 $\frac{1}{10}$ feet in length,[3] 57 $\frac{1}{10}$ feet in breadth,[3]

34 $\frac{85}{100}$ feet in depth,[3] of 7191 gross and

4389 net. Value of vessel, $ 1,750,000.

Thomas S McElroy

Sworn to before me this 4TH day of June 11, 1942

SEAL

J. Frank Batty Jr

Notary Public.

---

[1] Insert here the rig of the vessel. For a vessel having a steam engine write "steam side wheel," "steam stern wheel," "steam screw"; and for a vessel having an internal combustion engine write "gas (or oil) side wheel," "gas (or oil) stern wheel," "gas (or oil) screw," or as the case may be.

[2] The customs officer who issues the first marine document to this vessel must see that the name therein given agrees *exactly* with the name given in this certificate.

[3] Dimensions are to be calculated as specified in R. S. 4150.

[4] The master carpenter or builder should not sign this certificate until he knows that the name as above written agrees *exactly* with that marked on the vessel.

(OVER)

The following additional particulars should be given for the engine of machinery-propelled vessels:

Type Reciprocating
(Reciprocating, beam, turbine, etc., if steam; oil, gas, etc., if internal combustion)

Built at Harrison, New Jersey, in 1942

By Worthington Pump & Machinery Company

Power: Steam
(Steam, heavy oil, light oil, gasoline, naphtha, etc.)

NOTE.—The *oil* engine is an internal-combustion engine in which the fuel is injected into the air that is under compression in the cylinder, and the combination is ignited by the heat generated from the compression (Diesel type), or from additional outside heat when that in the cylinder is not sufficient (Semi-Diesel type). The *gas* engine is also an internal-combustion engine, but in it the fuel and air are admitted into the cylinder simultaneously and the combination is ignited by a spark.

APPENDIX - R

Sanitation Certificates

DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE

PHS-457
REV. 12-50

CERTIFICATE of SANITARY CONSTRUCTION

GT/S WILLIAM PATTERSON - 241879
(Conveyance)

Bethlehem Steel - Baltimore, Md.
(Built or repaired by)

Maritime Administration
U.S. Dept. of Commerce
(Built or repaired for)

This is to certify that an inspection was made of this conveyance and that at the time of inspection the features of sanitary construction and the sanitation facilities were found satisfactorily to meet the standards of the Public Health Service. **"This vessel was constructed in accordance with the Public Health Service requirements for ratproofing".**

A. Atkins
Regional Engineer

700 East Jefferson Street
Charlottesville, Virginia
Address

L E Burney
Surgeon General, USPHS

September 13, 1957
Date

PHS-732
Rev. 9-55

DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE

~~DERATTING CERTIFICATE (a) — CERTIFICAT DE DERATISATION (a)~~

DERATTING EXEMPTION CERTIFICATE (a) — CERTIFICAT D'EXEMPTION DE LA DERATISATION (a) # 166

issued in accordance with Article 52 of the International Sanitary Regulations
Délivré conformément à l'article 52 du Règlement Sanitaire International
(*Not to be taken away by Port Authorities.*) — (Ce certificat ne doit pas être retiré par les autorités portuaires.)

PORT OF / PORT DE Baltimore, Maryland Date / Date September 11, 1957

THIS CERTIFICATE records the inspection and { *deratting* / ~~*exemption*~~ } (a) *at this port and on the above date*

LE PRÉSENT CERTIFICAT atteste l'inspection et { la dératisation / l'exemption } (a) en ce port et à la date ci-dessus

of the { *ship* / ~~*inland navigation vessel*~~ } (a) / du navire — American S/S WILLIAM PATTERSON

of / de { 4,518 *net tonnage for a sea-going vessel* / tonnage net dans le cas d'un navire de haute mer; ______ *tonnage for an inland navigation vessel* / tonnage dans le cas d'un navire de navigation interieure } (a) (f)

At the time of { *inspection* / ~~*deratting*~~ } (a) *the holds were laden with* None *tons of* ______ *cargo*

Au moment de { l'inspection / la dératisation } (a) les cales étaient chargées de ______ tonnes de ______ cargaison

COMPARTMENTS (b)	RAT INDICATIONS TRACES DE RATS (c)	RAT HARBORAGE — REFUGES A RATS: discovered / trouvés (d)	RAT HARBORAGE — REFUGES A RATS: treated / supprimés	DERATTING – DÉRATISATION: by fumigation — par fumigation; Fumigant — Gaz utilisé; Hours exposure — Exposition (heures): Space (cubic feet) / Espaces (mètres cubes)	Quantity used / Quantités employées (e)	Rats found dead / Rats trouvés morts	by catching, trapping, or poisoning / par capture ou poison: Traps set or poisons put out / Pièges ou poisons mis	Rats caught or killed / Rats pris ou tués	COMPARTIMENTS (b)
Holds 1.	None	None							Cales 1.
— 2.	None	None							— 2.
— 3.	None	None							— 3.
— 4.	None	None							— 4.
— 5.	None	None							— 5.
— 6.	No space								— 6.
— 7.	No space								— 7.
Tween ~~XXXXX~~ *deck space*	None	None							Entrepont
Bunker space	Oil Burner								Soute à charbon
Engineroom and shaft alley	None	None							Chaufferies, tunnel de l'arbre
Forepeak and storeroom	None	None							Peak avant et magasin
Afterpeak and storeroom	None	None							Peak arrière et magasin
Lifeboats	None	None							Canots de sauvetage
Charts and wireless rooms	None	None							Chambre des cartes, T. S. F.
Galley	None	None							Cuisines
Pantry	None	None							Cambuses
Provision storerooms	None	None							Soute à vivres
Quarters (crew)	None	None							Postes (équipage)
Quarters (officers)	None	None							Chambres (officiers)
Quarters (cabin passengers)	None	None							Cabines (passagers)
Quarters ~~XXXXX~~ Capt.	None	None							Postes (émigrants)
Saloon	None	None							Salon
Messrooms	None	None							Salle à manger de l'équipage
Refrigerated storerooms	None	None							Soute à vivres réfrigérées
Deck houses	None	None							
TOTAL									TOTAL

DO NOT REMOVE FROM SHIP

(a) *Strike out the unnecessary indications.* — Rayer les mentions inutiles.
(b) *In case any of the compartments enumerated do not exist on the ship or inland navigation vessel, this fact must be mentioned.* — Lorsqu'un des compartiments énumérés n'existe pas sur le navire, on devra le mentionner expressément.
(c) *Old or recent evidence of excreta, runs, or gnawing.* — Traces anciennes ou récentes d'excréments, de passages ou de rongements.
(d) *None, small, moderate, or large.* — Néant, peu, passablement ou beaucoup.
(e) *State the weight of sulphur or of cyanide salts or quantity of HCN acid used.* — Indiquer les poids de soufre ou de cyanure ou la proportion d'acide cyanhydrique.
(f) *Specify whether applies to metric displacement or any other method of determining the tonnage.* — Spécifier s'il s'agit de déplacement métrique ou, sinon, de quel autre tonnage il s'agit.

RECOMMENDATIONS MADE. — OBSERVATIONS. — *In the case of exemption, state here the measures taken for maintaining the ship or inland navigation vessel in such a condition that the number of rats on board is negligible.* — Dans le cas d'exemption, indiquer ici les mesures prises pour que le navire soit maintenu dans des conditions telles que le nombre de rats à bord soit négligeable.

Due to the absence of rat life, it is recommended that formal inspection and fumigation be waived for a period of six months, unless plague infected or suspected ports are visited, or evidence of rat activity is noted during that period.

F. C. Foss F. C. Foss, Quarantine Inspector, PHS
Seal, name, qualification, and signature of the inspector. — Cachet, nom, qualité et signature de l'inspecteur

APPENDIX - S

Certificate of Completion

UNITED STATES DEPARTMENT OF COMMERCE
MARITIME ADMINISTRATION
Office of Ship Construction and Repair
Washington 25, D. C.

CERTIFICATE OF COMPLETION

Date: 14 September 1957

This is to certify that GAS TURBINE SHIP WILLIAM PATTERSON U. S. DEPARTMENT OF COMMERCE, MARITIME ADMINISTRATION, MCE Hull No. 48, Contractor's Hull No. 2035 has been completed in accordance with Contract No. MA 1078, Dated 9 August 1955, between the U. S. DEPARTMENT OF COMMERCE, MARITIME ADMINISTRATION and Bethlehem Steel Co., Shipbuilding Division, Baltimore, Maryland, and to the requirements of approved plans, changes, and specifications, but subject to clearance of all allowance list shortages (including fuel oil, lube oil, and fresh water) by the Inventory Section of the Division of Purchase and sales, Office of Property and Supply.

This is evidenced further by the Certificates herewith presented, issued by the American Bureau of Shipping, Coast Guard, Customs, Public Health Service, and other regulatory bodies.

There are three (3) items of exception.

Note: Exceptions are shown on attached "Exhibit A."

Signed: R. A. Leaf
Title: Assistant to Manager
For: Bethlehem Steel Co., Shipbldg. Div.
(Contractor)

Signed: Walter H. Beattie
WALTER H. BEATTIE
Title: Construction Representative
For: U. S. Department of Commerce
Maritime Administration
Office of Ship Construction
and Repair

APPENDIX - T

Certificate of Proof Test to Cargo Gear as a Unit

FORM A. B. CG-4 2-56

AMERICAN BUREAU OF SHIPPING

CERTIFICATE NO.	B-267036
NAME OF VESSEL	S.S. "WILLIAM PATTERSON"
OFFICIAL NUMBER	241,879
PORT OF REGISTRY	Baltimore, Maryland
DATE	May 21, 1957
PORT OF SURVEY	Baltimore, Maryland
GROSS TONNAGE	7235
OWNERS	United States of America

CERTIFICATE OF PROOF TEST TO CARGO GEAR AS A UNIT

Form for Original Tests, Quadrennial Surveys and Tests Associated with Repairs.

LOCATION AND DESCRIPTION OF GEAR	PROOF LOAD APPLIED	SAFE WORKING LOAD OF ASSEMBLED GEAR	ANGLE OF BOOM
No. 1 Hatch			
Two 5 ton steel booms and gear.	14,000# ea.	5 ton	15°
No. 2 Hatch			
Four 5 ton steel booms and gear.	14,000# ea.	5 ton	15°
One 50 ton steel boom and gear.	123,200# ea.	50 ton	25°
No. 3 Hatch			
Two 5 ton steel booms and gear.	14,000# ea.	5 ton	15°
No. 4 Hatch			
Two 5 ton steel booms and gear.	14,000# ea.	5 ton	15°
One 15 ton steel boom and gear.	42,000# ea.	15 ton	15°
No. 5 Hatch			
Two 5 ton steel booms and gear.	14,000# ea.	5 ton	15°

Has the foot of the boom been properly marked? Yes

Has the register of cargo gear been endorsed? Yes

List special shrouds, if any, for heavy lift gear Two 2-3/8" Preventer Stays for 50 ton boom.

Remarks: Loose Gear Stamped AB 5-57.

This is to Certify that the above mentioned gear was proof tested as shown and that a careful examination after test showed that it has withstood the proof load without injury or permanent deformation.

R. F. English

R. F. English, Surveyor

This Certificate is granted subject to the condition that it is understood and agreed that neither the Bureau nor any of its Committees is under any circumstances whatever to be held responsible for any inaccuracy in any report or certificate issued by this Bureau or its Surveyors or in any entry in the Record or other publication of the Bureau or for any error of judgment, default or negligence of its Officers, Surveyors or Agents.

OVER

EXTRACT FROM

Requirements for the Certification of the Construction and Survey of Cargo Gear on Merchant Vessels.

Section 3 — ORIGINAL TESTS TO CARGO GEAR

(3) Proof Test To Gear as a Unit

(a) Before the Cargo Gear (excepting the slings, see Section 8) is placed in service, it shall be tested on the vessel to the following proof loads:

Working load of Assembled Gear	Proof Load
Up to 20 tons	25 percent in excess
20-50 tons	5 tons in excess
Over 50 tons	10 percent in excess

(b) Unless otherwise approved the proof load shall be applied by hoisting movable weights with the cargo boom at an angle to the horizontal which shall be stated in the certificate of the test. This angle shall not be greater than 15° to the horizontal for loads up to and including 10 tons and 25° for loads above 10 tons or when these angles are impracticable, at the lowest practicable angle. After the proof load has been lifted, it shall be swung as far as possible in both directions. After being tested as aforesaid, all Cargo Gear, with the whole of the gear accessory thereto, and all chains, rings, hooks, links, shackles, swivels, pulley blocks or other loose gear shall be examined, to see whether any part has been injured or permanently deformed by the test.

(c) Current for electrical winch operation during the test shall be taken through the ship's cables. Shore current may be used when connected to the main switchboard.

(d) On all types of winches, efficient means shall be provided to stop and hold the load in any position, and such means shall be demonstrated. Where electrical winches are fitted with efficient electro-magnetic brakes, mechanical brakes for manual operation will not be required but if fitted shall be in operating condition.

(e) The safe working load, SWL, for the assembled gear shall be marked on the heel of all booms and cranes in white or other suitable color, with minimum angle to the horizontal at which this load may be applied and date of test. Letters and numbers to be at least 1 inch high.

(f) Copy of the certificate of cargo gear test issued by the Surveyors shall be attached to the Register of Cargo Gear, see Section 11.

Section 4—EXISTING VESSELS

The cargo gear of existing vessels may be certificated subject to satisfactory compliance with the requirements for the proof testing of the gear as a unit and the subsequent examinations as required by Section (3) Paragraph 3 for new gear with the exception that if movable weights are not available, a spring or hydraulic balance may be used. In the case of use of a spring or hydraulic balance, the proof load shall be applied with the boom swung as far as possible, first in one direction and then in the other. The Surveyor may at his discretion require the proof load to be applied with the boom at intermediate positions. The test should not be regarded as satisfactory unless the indicator remains constant for a period of at least five minutes. As a part of the examination subsequent to the proof test, the pins are to be removed from the sheaves and pulley blocks for examination. Where practicable, the submission of calculations and the furnishing of diagram as called for with new gear in Section 2, paragraph 2(b) may be required. In all cases, appropriate means shall be provided to prevent the foot of the boom from being accidentally lifted out of its socket. Articles of loose gear shall be marked AB (date of test) and so indicated on the certificate of test identified in Section 12.

Section 5 — PERIODICAL SURVEYS

(2) Quadrennial Survey

At intervals of 4 years, the Cargo Gear shall require to undergo the proof loads and examination stated in Section 3, paragraph (3), together with removal of pins from sheaves and pulley blocks for examination. If movable weights are not available, a spring or hydraulic balance may be used. In the case of use of a spring or hydraulic balance, the proof load shall be applied with the boom swung as far as possible, first in one direction and then in the other The Surveyor may at his discretion require the proof load to be applied with the boom at intermediate positions. The test should not be regarded as satisfactory unless the indicator remains constant for a period of at least five minutes. Certificate of survey to be furnished and attached to Register of Cargo Gear, Section 11.

Section 7 — REPAIRS AND ADDITIONS TO CARGO GEAR

(1) Mast, booms and permanent fittings

When important repairs or renewals are required to be made to the masts, booms and permanent fittings of cargo gear, the repairs shall be carried out under the supervision and to the satisfaction of the Surveyors. Tests and examination of the particular cargo gear as may be deemed necessary are to be carried out in accordance with Section 3, paragraph (3), but spring or hydraulic balances may be used in lieu of weights. When in a port where a Surveyor is not available, the tests and examination may be made by an officer of the ship designated by the master, subject to confirmatory test and inspection by the Surveyors at the first available opportunity. Certificates covering tests to be attached to Register of Cargo Gear, Section 11.

Spring balance used in lieu of movable weights - changes adopted January 1963.

APPENDIX - U

Panama Canal Tonnage Certificate

#2:

File No.

PANAMA CANAL TONNAGE CERTIFICATE

American (NATIONALITY) ______ (TYPE) Oil (POWER) /S WILLIAM PATTERSON (NAME OF SHIP)

4400-8—Revised 6-24-48

MR 65545—Panama Canal—10-7-54—2,000

OFFICIAL NUMBER	SIGNAL LETTERS	PORT OF REGISTRY	REGISTERED TONNAGES GROSS	REGISTERED TONNAGES NET	LENGTH	BEAM	DEPTH
241879	K F V C	Baltimore, Md.	7275.25	4518.11	448.7	57.1	34.8

DETAILS OF PANAMA CANAL GROSS TONNAGE

	TONS OF 100 CUBIC FEET	TONS OF 100 CUBIC FEET
The spaces measured for gross tonnage in this ship comprise the following and no others, viz:		
1. Under the tonnage deck, viz:		
(a) Between tonnage deck and double bottom	6831.16	
(b) Double-bottom compartments for cargo (Art. IV, Sec. 4.)		
Total space under tonnage deck		6831.16
2. Between tonnage deck and upper deck: Lower tween deck		
Upper tween deck		
3. Permanently covered and closed-in spaces above the upper deck:	TONS OF 100 CUBIC FEET	
(a) Forecastle		
(b) Bridge space		
(c) Poop		
(d) Break or breaks		
(e) Turret ______ tons, (f) Trunk ______ tons		
(g) Roundhouses 225.95 tons, 34.01 tons (1st Tier), ______ tons, ______ tons, ______ tons		
______ tons, 119.97 tons, ______ tons (2nd Tier), ______ tons, ______ tons, ______ tons		
______ tons, 94.79 tons, ______ tons (3rd Tier), ______ tons, ______ tons, ______ tons		
______ tons, 8.13 tons, ______ tons (4th Tier), ______ tons, ______ tons, ______ tons	482.85	
(h) Mast houses 5.37 tons, 5.37 tons, 5.37 tons, ______ tons, ______ tons		
Mast houses ______ tons, ______ tons, ______ tons, ______ tons, ______ tons	16.11	
(n) Hatchways 18.90 tons, 19.60 tons, 11.20 tons, 19.60 tons, 19.60 tons		
.40 tons, .14 tons, ______ tons, ______ tons, ______ tons, ______ tons		
______ tons, ______ tons, ______ tons, ______ tons, ______ tons, ______ tons		
______ tons, ______ tons, ______ tons, ______ tons, ______ tons, ______ tons		
Total 89.44 tons. One-half percent of the gross tonnage 36.65 tons. Excess	52.79	
Total permanently covered and closed-in spaces above the upper deck		551.75
PANAMA CANAL GROSS TONNAGE		7382.91

Gross per contra 7382.91

DEDUCTIONS FROM GROSS TONNAGE*

			TONS OF 100 CUBIC FEET	TONS OF 100 CUBIC FEET
1. Crew accommodations:				
(a) Apprentices tons,	Donkeyman tons,	Cooks 6.66 6.79 tons	134.73	
Boatswain 7.45 tons,	Pumpmen tons,	tons		
Carpenter tons,	E. R. Hands 5.18 tons,	Stewards 9.38 tons		
Quartermasters tons,	7.24 6.84 tons,	tons		
Seamen 7.41 9.94 tons,	tons,	Laundry 7.86 tons		
7.45 tons,	tons,	tons, tons		
Deck Maint 7.24 tons,	tons,	tons, tons		
Passageways 14.01 tons,	14.57 tons, 2.02 tons,	7.50 tons, tons		
2.02 .71 tons,	.71 tons, tons,	3.75 tons, tons		
(b) Messrooms 13.32 tons,	tons,	tons	36.23	
Lounge tons,	tons,	tons		
Bathrooms 1.03 tons,	tons,	tons		
1.03 1.97 tons,	tons,	Med. Lkr. 1.12 tons		
Seamen's W. C. 3.54 tons,	Hospital W. C. 3.41 tons,	Hospital 6.78 tons		
Steward's 1.31 tons,	Motormen 1.31 tons,	Crew WC 1.41 tons		
2. Officers' accommodations:				
(a) Ch. Offr's cabin 7.86 tons,	Ch. Engr's Cabin 8.77 tons,	Doctor tons	124.12	
Ch. Offr's Office tons,	Ch. Engr's Office 7.86 tons,	Purser tons		
2d Officer 7.39 tons,	2d Engineer 6.39 tons,	Radio Operator 5.73 tons		
3d Officer 6.89 tons,	3d Engineer 6.50 tons,	tons		
4th Officer tons,	4th Engineer 6.53 tons,	Chief Steward 7.45 tons		
Pilot tons,	5th Engineer 6.53 tons,	Electrician 6.87 tons		
Cadets tons,	6th Engineer tons,	Ch. Refrig. Engr. tons		
Oilskins .31 tons,	tons,	tons		
tons,	tons,	2.44 1.25 tons		
Passageways 2/ 2.18 tons,	3.09 tons, 6.94 tons,	3.56 tons, 2.44 tons		
2.44 tons,	3.09 tons, 3.56 tons,	4.13 tons, 3.92 tons		
(b) Messrooms: Offrs' 21.60 tons,	Engrs' tons,	Petty Offrs' 10.06 tons	47.11	
Lounge tons,	tons,	tons		
Bathrooms: Offrs' 3.52 tons,	Engrs' tons,	Petty Offrs' 2.25 tons		
" 1.94 tons,	tons,	tons		
Officers' W. C. 3.52 tons,	Engineers' W. C. tons,	Petty Offrs' W. C. 2.44 tons		
1.78 tons,	tons,	tons		
(c) Master's Cabin 7.53 tons,	Office 8.94 tons,	Bath 2.16 tons	18.63	
Passageways tons,	tons,	W. C. tons		
3. Galleys, etc., for exclusive use of officers and crew:				
Galley 16.88 tons,	Pantry (Offrs') tons,	Bakery tons	21.46	
Scullery 4.58 tons,	Pantry (Engrs') tons,	tons		
§5. Spaces used in working the ship:				
Wheelhouse 8.13 18.10 tons,	Chain locker 18.90 tons,	Carpenter shop 14.07 tons	206.18	
Chart house 6.60 tons,	Anchor gear tons,	Ice machine 15.72 tons		
Radio house 5.94 tons,	Steering gear 88.09 tons,	Battery room 1.31 tons		
Lookout houses tons,	Dynamo tons,	Fire Ext. Machy 24.87 tons		
Gyro compass tons,	Pump room tons,	Donkey boiler tons		
Radar tons,	tons,	Fath. Gen. .97 tons		
Passageway 3.48 tons,	tons,	Passageways tons		
6. Sailroom, Art. X, Sec. 6 (limited)†	tons,	Total tons	20.96	
Engineer's shop, Art. X, Sec. 7 (limited)	tons,	Total 20.96 tons		
7. Boatswain's storerooms, Art. X, Sec. 7:	Peaks 24.85 39.10 tons,	Lamp room 2.68 tons	73.82	
tons,	Deck 1.53 4.21 tons,	Paint room 2.68 tons		
tons,	" 1.53 tons,	Total 76.58 tons		
8. Water ballast or fresh water spaces,	F. P. T. 42.14 tons,	A. P. T. 45.95 tons	160.38	
Art. X, Sec. 10 tons,	Deep Tank 72.29 tons,	tons		
9. Public rooms for passengers, Art. X, Sec. 11 (Itemized on page 3)		tons		
	Total deduction other than propelling power*			843.62
	PANAMA CANAL NET TONNAGE (without deduction for propelling power)			6539.29

10. DEDUCTION FOR PROPELLING POWER: [Show Detailed Measurements on page 4]

			TONS OF 100 CUBIC FEET	
(a) Engine room as measured (Arts. XII, XIII, XIV)	Below deck 792.97 tons,	Tween deck tons	792.97	
	In bridge tons.	In poop tons		
and (b) In a vessel with screw propellers +75 percent of engine room as measured (Danube Rule)			594.72	
or (c) With fixed coal bunkers or tanks and compartments fitted for stowage of fuel oil				
Total deduction for propelling powers #				1387.69
PANAMA CANAL NET TONNAGE (power deduction by Arts. XII, XIII, or XIV)				5151.60

Bunker fuel for BALLAST RATE limited to: Coal long tons or Oil 2608 long tons

---

* No space, other than fuel spaces deducted under Article XIII of the Panama Measurement Rules, shall be deducted unless the use to which it is to be exclusively devoted has been appropriately designated by official marking.
† Reference to articles and sections are to the "Rules for the Measurement of Vessels for the Panama Canal."
# Limited to 50 percent of gross tonnage. § Item 4 omitted on revised form.

Public rooms for passengers deducted under item 9, page 2:

LOCATION	NAME OF SPACE	TONS	LOCATION	NAME OF SPACE	TONS

Total

SPACES NOT INCLUDED IN GROSS TONNAGE

The following spaces and no others have been exempted from gross tonnage

1. Open deck spaces, Art. IV, Sec 1 (a)—(Name and give location) Recesses 1st. Tr. 3.76 ; 2nd Tr. 1.35 ; 3rd Tr. 9.71

2. Opposite end openings, Art. IV, Sec. 1 (b)—(Name and state dimensions and tonnages):
Forecastle
Bridge
Poop

3. Opposite side openings, Art. IV, Sec. 1 (c)—(Name and state dimensions and tonnages):
Forecastle
Bridge
Poop

4. Opposite side openings, Art. IV, Sec. 2—(State location, dimensions and tonnages):

5. Above the lowest side-to-side erection, Art. IV, Sec. 3—(State tier, dimensions and tonnages):

FRAMED IN AROUND FUNNELS:			FRAMED IN AROUND LIGHT AND AIR CASINGS:		
TIER	DIMENSIONS	TONS	TIER	DIMENSIONS	TONS
3rd. Tr.	12.5 x 13.0 x 7.5	12.19	1st. Tr.	15.0 x 20.0 x 7.5)	
1st. Tr. Esc.	2.5 x 2.5 x 7.5	.47	less	5.5 x 3.0 x 6.0)	21.51
Skylight	8.7 x 15.0 x 4.15	5.41		12.5 x 15.0 x 7.5	14.06
				2.15 x 4.0 x 7.5	.65
			2nd. Tr.	12.15 x 13.0 x 7.5	12.19

6. Double-bottom spaces, Art. IV, Sec. 4—(Name or give numbers of the compartments)

7. Companion houses, Art. IV, Sec. 6—(State location and tonnages):

LOCATION		TONS	LOCATION	TONS
Mast Houses	3/	4.32		
Aft. House		.50		
1st. Tier	.88	.88		
3rd. Tier		1.03		

8. Domes, skylights and air-shafts, Art. IV, Sec. 7—(State location and tonnages):

LOCATION		TONS	LOCATION	TONS
Vents. Mast Houses	3/	4.32		

9. State any other particulars of exempted spaces Ceiling in holds 3.63

THIS IS TO CERTIFY that the American M/ ship WILLIAM PATTERSON has been measured in accordance with the Rules for Measurement of Vessels for the Panama Canal, and that the particulars of tonnage contained in this Certificate are correct. A.C. Livingston (Admeasurer)
(Nationality) (Name of ship)

Given under my hand at Baltimore, Maryland this 8 th day of May, 19 57

(Signature)
Deputy Collector
(Official Position)

(OVER)

DETAILED MEASUREMENTS FOR PROPELLING POWER DEDUCTION
(Item 10 page 2)

NAME AND LOCATION	DIMENSIONS	TONS
Lower	50.0 x 54.9 x 25.0	686.25
Upper	47.55 x 22.05 x 9.9	103.80
Thrust recess	10.0 x 8.05 x 11.3	9.10
Shaft alley	110.0 x 5.0 x 5.6)	
plus	110.0 x(2.5)2 x π x ½)	41.60
Esc. Fwd.	2.5 x 3.6 x 17.[illegible]5)	
plus	2.3 x 3.85 x 9.9)	2.49
Esc. Aft.	2.5 x 2.5 x 28.2	1.76
Shaft Recess	6.5 8.0 x 4.6 x 9.6 2.7	3.53
plus	13.40 15.0 x 9.58 x 9.6 5.86	13.82
TOTAL:		862.35
LESS: Spaces Deleted		69.38
To item 10 page 2		792.97

NAME AND LOCATION	DIMENSIONS	TONS
SPACES DELETED:		
Settling Tks.	20.0 x 4.45 x 17.75 x 2	31.60
Engrs. Shop	15.0 x 17.25 x 8.1	20.96
Lube oil (port)	20.0 x 4.2 x 7.25	6.09
Lube oil (stbd)	12.55 x 5.05 x 7.25	4.59
F.W. (feed tank)	3.0 x 4.0 x 3.5	[illegible]
F.O. (day tank)	9.3 x 3.5 x 5.0	1.[illegible]
F.W. (make up Tk.)	3.0 x 4.1 x 4.5	.55
F.O. (day tank)	3.25 x 3.25 x 3.9	.41
Pumps & tks on Settler	10.7 x 4.5 x 6.5	3.13
Total: Spaces deleted		69.38

APPENDIX - V

Suez Canal Tonnage Certificate

Customs Form 1417
TREASURY DEPARTMENT
WASHINGTON, D. C., U. S. A.
Oct. 1951

ORIGINAL

SUEZ CANAL
SPECIAL TONNAGE CERTIFICATE

UNITED STATES CUSTOMS SERVICE

Oil /S. WILLIAM PATTERSON
(Type) (Name of vessel)

Official No. 241879 Signal Letters K F V G Port of Registry Baltimore, Md.

Tonnage on Certificate of Registry: Gross 7275.25 Net 4518.11 Register Length 445.7 Breadth 57.1 Depth 34.8

DETAILS OF TONNAGE

FOR THE ABOVE-NAMED VESSEL WHEN PASSING THROUGH THE SUEZ CANAL

	Cubic meters	Tons of 100 cubic feet each	
The spaces measured for gross tonnage in this vessel comprise the following and no others, viz:			
Space under the tonnage deck		6831	16
Double bottom compartment (drain tank) as integral part of propelling machinery		3	43
Lower between decks ...., second between ...., upper between			
Closed-in spaces under or in permanent constructions above the uppermost deck, viz:			
Forecastle, etc.			
Bridge space			
Poop			
Break or breaks			
Turret			
Trunk			
Deckhouses, 1st tier 262.17 tons, 0.47 tons, 34.01 tons, ... tons, ... tons			
" 2d tier 120.85 tons, ... tons, ... tons, ... tons, ... tons			
" 3d tier 95.73 tons, ... tons, ... tons, ... tons, ... tons		521	36
" 4th tier 8.13 tons, ... tons, ... tons, ... tons, ... tons			
" .... tons, ... tons, ... tons, ... tons, ... tons			
Mast ~~Side~~ houses 5.37 tons, 5.37 tons, 5.37 tons, ... tons, ... tons		16	11
" .... tons, ... tons, ... tons, ... tons, ... tons			
Hatchways 18.90 tons, 19.60 tons, 11.20 tons, 19.60 tons, .40 tons			
" .14 tons, 19.60 tons, ... tons, ... tons, ... tons			
Aggregate tonnage of hatchways 89.44 Excess above one-half percent of the gross tonnage		52	58
GROSS REGISTER TONNAGE		7424	64
Total deduction, exclusive of propelling power, limited to 10 percent gross tonnage (see page 2)		350	08
Net register tonnage, exclusive of deduction for propelling power		7074	56
DEDUCTION FOR PROPELLING POWER			
Either (1) applicable to vessels with fixed bunkers—			
Total deduction for propelling power* (see page 2)			
Net register tonnage of vessel by actual measurement			
Or (2) Danube Rule—			
Deduction for propelling power* (see page 2)		1407	22
Net register tonnage of vessel by Danube Rule		5667	34

*This deduction is not, except in the case of tugs, to exceed 50 percent of the gross register tonnage of the vessel.

THIS IS TO CERTIFY that the vessel of the United States of America above named has been admeasured, and that the tonnage ascertained as above is in accordance with the rules adopted by the International Tonnage Commission at Constantinople.

Given under my hand at Baltimore, Md., this 8th day of May, 1957

[redacted]

Commissioner of Customs.

Deputy Collector of Customs for the District of Maryland

10—29947-8

DEDUCTIONS FROM GROSS TONNAGE

	Tons		Tons		Tons		Tons	Cubic Meters	Tons of 100 Cubic Feet Each	
Deck Officers:										
Captain's room	7.53	Captain's office	8.94	Captain's bath	2.16	Passageway				
Chief officer's room	7.86	Chief officer's office		Chief officer's bath						
2d officer	7.39	3d officer	6.89	4th officer						
Doctor's room [1]		Boatswain	7.45	Carpenter		Steward [1]	7.45			
Electrician	6.87	Quartermaster				Radio operator	5.73		105.19	
Wardrobes		Oilskin lockers	.31	Life-belt lockers		Smoking room				
Library						Messroom P. O.	10.06			
Galley [1]		Pantry [1]		Scullery		Bar				
Water closets 3.52	1.78	Bathrooms [1] 1.94	2.35	Lavatories [1]		Showers [1] P. O.	2.25			
						P. O. WC	2.44			
Passageways	2.01 2.44		2.44 4.13		1.25					
Engine Room Officers:										
Chief engineer's room	8.77	Chief engineer's office	7.86	Chief engineer's bath	1.92					
2d engineer	6.39	3d engineer	6.50	4th engineer	6.53	Jr. 3"Asst Eng	6.53			
Wardrobes		Oilskin lockers		Life-belt lockers		Smoking room				
Library						Messroom			56	90
Galley [1]		Pantry [1]		Scullery		Bar				
Water closets		Bathrooms [1]		Lavatories [1]		Showers [1]				
Passageways	7.78 4.62									
Crew Accommodations:										
Apprentices		Cooks	6.79	Firemen		Donkeymen				
Greasers		Mess boys [1]		Motormen 7.24 6.84	5.18	Oilers				
Seamen 9.94	7.41	Water tenders		Wipers		Night watchmen [1]				
Seamen 7.24	7.45	Engineers' storekeeper				Firefighting personnel				
Wardrobes		Oilskin lockers		Life-belt lockers						
Library				Bakery		Messroom	13.32			
Galley [1]		Pantry [1]		Scullery	4.58					
Water closets 1.31 1.31	3.54 1.41	Bathrooms [1]	1.97	Lavatories [1]		Showers [1] 1.03	1.03		119	39
		Drying room		Bar						
Refrigerating machinery		Distilling apparatus		Slop sink		Disinfecting apparatus				
Hospital [1]	6.78	Operating room [1]		Infirmary		Consulting room [1]				
Chemistry laboratory [2]	1.12	Dispensary [1]		Hospital WC	3.41					
Passageways	16.74 3.75									

Except as indicated in footnote [1] below, the above spaces are subject to deduction only if they are occupied by, or are for the exclusive accommodation of the officers, engineers, and crew.

	Tons		Tons		Tons		Tons	Cubic Meters	Tons of 100 Cubic Feet Each	
Miscellaneous:										
Ventilators [1]		Firefighting equipment	24.87	Boilers [1]		Emergency dynamos			24	87
Closed-in spaces above the uppermost deck used in working the vessel:										
Anchor gear		Chain locker		Chart house	6.60	Donkey boiler [1]				
Gyro compass		Lookout houses		Lamp room	2.68	Radio	5.94			
Radar		Searchlight spaces		Signal house		Steering gear			43	73
Wheel house 8.13	18.10	Submarine telephone		Direction finder		Sounding spaces				
						Radio Battery	1.31			
Passageways [1]						Bath. Gen.	.97			
Total									350	08
Deduction, exclusive of propelling power (limited to 10 percent of the gross tonnage)									742	46

DEDUCTION FOR PROPELLING POWER

	Tons of 100 Cubic Feet	Cubic Meters	Tons of 100 Cubic Feet Each	
Either (1) applicable to vessels with fixed bunkers—				
(a) Engine room as measured. This includes water-tight shaft trunk and all spaces set apart for the working of the machinery and boilers				
(b) Permanent coal bunkers as measured				
Total deduction for propelling power				
Total deduction for vessel				
Or (2) Danube Rule—				
(a) Engine room as measured. This includes water-tight shaft trunk and all spaces set apart for the working of the machinery and boilers Below 767.44 1st Tier 36.69	804.13			
(b) In a screw steamer +75 percent of engine room as measured	603.09			
(c) In a paddle steamer +50 percent of engine room as measured				
Deduction for propelling power			1407	22
Total deduction for vessel by the Danube Rule			1757	30

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[1] Deductions subject to special conditions. See "Suez Canal Special Tonnage Certificates (Instructions to American Officers)" and subsequent instructions.
[2] Pharmacy.

FULL DIMENSIONS AND TONNAGE OF EXEMPTED AND OPEN SPACES

Length from inside the stem at half the height of the forecastle to the inside of the stern timber at half the height of the poop = ______ feet

One-eighth length = ______ feet

One-tenth length = ______ feet

Particulars of Deck Spaces		Tons
Mast Houses		
5.5 x 20.0 x 7.5 x 3	24.75	
Exempt:	8.64	16.11
1. 1st Tier		
74.05 x 48.2 x 7.5	267.69	
Less open recesses		
3.5 x 3.4 x 7.5 x 2) 4.0 x 1.5 x 7.5 x 2) 2.4 x 3.0 x 7.5 x 2)	3.76 263.93	
Exempt:	1.76	262.17
Mid. 2nd Tier		
46.55 x 35.05 x 7.5) 11.0 x 6.75 x 7.5 x 2)	133.51	
Less open recesses		
3.0 x 3.0 x 7.5 x 2	1.35 132.16	
Exempt:	11.31	120.85
Mid. 3rd Tier		
5.0 x 23.0 x 7.5) 41.5 x 35.05 x 7.5)	117.72	
Less open recesses		
7.5 x 13.05 x 7.5) 5.0 x 3.05 x 7.5) 2.35 x 7.0 x 7.5)	9.71 108.01	
Exempt:	12.28	95.73
Mid 4th Tier		
9.35 x 9.35 x 9.3		8.13
Aft 1st Tier		
15.5 x 22.35 x 7.5) 5.8 x 19.6 x 7.5)	34.51	
Exempt:	.50	34.01

Particulars of Exempted Spaces		Tons
Vents 5.5 x 3.5 x 7.5 x 3	4.32	
Comps 5.5 x 3.5 x 7.5 x 3	4.32	8.64
Mid. 1st Tier		
Companions 5.1 x 2.3 x 7.5 x 2		1.76
Mid. 2nd Tier		
Engine Casing 12.5 x 13.0 x 7.5 Less 3.5 x 6.5 x 3.85		11.31
Mid 3rd Tier		
Engine Casing 12.5 x 13.0 x 7.5) Less 3.5 x 6.5 x 4.15)	11.25	
Companion 2.5 x 5.5 x 7.5	1.03	12.28
Aft 1st Tier		
Companion 0.9/4.2 x 2.8 x 5.25) 4.2 x 2.8 x 1.1)		.50
Engine Skylight 8.7 x 15.0 x 4.15		5.41

DOUBLE BOTTOM COMPARTMENTS

Compartment No.	Use		Tons
No.1	F.O.	142.5 tons F.O	53.05
2 Stbd.	"	159.1 " "	59.23
2 Port	"	160.3 " "	59.67
3 Stbd.	D.O.	106.0 " D.O.	43.99
3 Port	"	10600 " D.O.	43.99
4 A (P.&S.)	F.W.	62. " F.W.	21.70
4 B (P.&S.)	"	114. " "	39.90
5 Stbd	F.O.	117.9 " F.O.	43.89
5 Port	"	117.9 " "	43.89
6	"	110.6 " "	41.17

UNITED STATES OF AMERICA
TREASURY DEPARTMENT
BUREAU OF CUSTOMS
WASHINGTON, D. C., U. S. A.

SUEZ CANAL

FOR THE

TONNAGE CERTIFICATE

Vessel

ENGINE SPACE

Lower	50.0 x 54.9 x 25.0		686.25
Upper	47.55 x 22.05 x 9.9		103.80
Thrust	10.0 x 8.05 x 11.3		9.10
Shaft	110.0 x 5.0 x 5.6) 110.0 x 2.5 x 2.5 x π /2)		41.60
Escape	2.5 x 3.6 x 17.85) 2.3 x 3.85 x 9.9)		2.49
Escape	2.5 x 2.5 x 28.2		1.76
Shaft Recess	6.5 8.0 x 4.6 x 9.6 2.7		3.53
	13.4 15.0 x 9.58 x 9.6 5.86		13.82
			862.35
Spaces Deleted:			
Donkey Boilers	20.5 x 13.0 x 13.5 /2	17.99	
Settling Tanks	20.0 x 4.45 x 17.75 x 2	31.60	
Engineer's Shop	15.0 x 17.25 x 8.1	20.96	
L. O. Tank	20.0 x 4.2 x 7.25	6.09	
L. O. Tank	12.55 x 5.05 x 7.25	4.59	
F. O. Day Tank	9.3 x 3.5 x 5.0	1.63	
F. O. Day Tank	3.25 x 3.25 x 3.9	.41	
Generator Flat	27.5 x 17.35 x 13.0 /2	31.01	
Feed Water Tank	3.0 x 4.1 x 4.5	.55	
"	3.0 x 4.0 x 3.5	.42	
Tanks & Pumps on Settler	10.7 x 4.45 x 6.5	3.09	118.34
			744.01
Add:			
Sump Tanks	7.5 x 15.0 x 2.0	2.25	
Tank	5.0 x 5.9 x 2.0 x 2	1.18	
Settling/Allowance	$\frac{6000 \times 20}{6000}$	20.00	23.43
			767.44
Casings:			
Engine 1st Tier	15.0 x 20.0 x 7.5) Less 5.5 x 3.0 x 6.0)	21.51	
" 1st Tier	12.5 x 15.0 x 7.5	14.06	
Escape	2.15 x 4.0 x 7.5	.65	
Escape	2.5 x 2.5 x 7.5	.47	36.69
			804.13

APPENDIX - W

American Bureau of Shipping Certificates

FORM A. B. 120 50M 3-57

AMERICAN BUREAU OF SHIPPING

CERTIFICATE NO. BA8202-X	PORT OF BALTIMORE, MD.

DATE SEPTEMBER 13, 1957

This is to Certify THAT THE UNDERSIGNED SURVEYORS TO THIS BUREAU DID, AT THE REQUEST OF THE OWNER'S REPRESENTATIVE, ATTEND THE G.T.S. "WILLIAM PATTERSON" OF BALTIMORE, MD., OFFICIAL NUMBER 241,879, ON THE 10TH DAY OF NOVEMBER 1955 AND SUBSEQUENT DATES AT THE BETHLEHEM-SPARROWS POINT SHIPYARD, INC., SPARROWS POINT, MD. IN CONNECTION WITH THE CONSTRUCTION OF A NEW LENGTHENED FOREBODY SECTION AND AS SHE LAY ON DRYDOCK AND AFLOAT AT THE BETHLEHEM STEEL COMPANY, BALTIMORE, MD., IN ORDER TO CARRY OUT THE ASSEMBLY AND CONVERSION OF NEW SECTION, SPECIAL SURVEY NO. 3 ON EXISTING HULL, THE RENEWAL AND INSTALLATION OF MAIN AND AUXILIARY MACHINERY AND BOILERS, STRAPPING OF DECK AND SHELL, ALTERATIONS TO EXISTING STERN FRAME, RENEWAL OF TAILSHAFT, LINESHAFT, PROPELLER, RUDDER AND ASSIGNMENT OF A NEW LOAD LINE: AND

THAT WE ARE TRANSMITTING TO THE COMMITTEE OF THE AMERICAN BUREAU OF SHIPPING, AT NEW YORK, A REPORT STATING THAT ALL RECOMMENDATIONS IN CONNECTION THEREWITH HAVE BEEN COMPLETED: AND

THAT THIS VESSEL NOW BEING ON THIS DATE IN A SEAWORTHY CONDITION IT IS RECOMMENDED THAT HER PRESENT CLASS WITH THIS BUREAU BE RETAINED, PENDING CONSIDERATION BY THE COMMITTEE OF OUR REPORTS.

M. A. Hansen
M. A. HANSEN, SURVEYOR

R. T. Brewton
R. T. BREWTON, SURVEYOR

R. F. English
R. F. ENGLISH, SURVEYOR

This Certificate is granted subject to the condition that it is understood and agreed that neither the Bureau nor any of its Committees is under any circumstances whatever to be held responsible for any inaccuracy in any report or certificate issued by this Bureau or its Surveyors or in any entry in the Record or other publication of the Bureau or for any error of judgment, default or negligence of its Officers, Surveyors or Agents.

Printed in U.S.A.

Form AB 130

AMERICAN BUREAU OF SHIPPING

CERTIFICATE NO. P-7419

PORT OF PHILADELPHIA, PA.

EQUIPMENT CERTIFICATE

DATE NOVEMBER 7, 1941

This is to Certify *that the following Equipment has been tested and inspected in accordance with the Rules of this Bureau, at the request of* THE BALDT ANCHOR CHAIN AND FORGE COMPANY, CHESTER, PA., ONE (1) BALDT STOCKLESS ANCHOR OF AN ACTUAL WEIGHT OF 8400 POUNDS (SPECIFIED WEIGHT OF 8400 POUNDS) TO A PROOF STRAIN OF 125690 POUNDS AND ONE (1) 2 9/16" X 17" X 11" PEAR SHAPED LINK TO A PROOF STRAIN OF 243930 POUNDS.

Verified
Fort Bower Anchor
SS WILLIAM PATTERSON, Hull 2035
AMERICAN BUREAU OF SHIPPING
Surveyor

	Anchor	Pear Shaped Link
Markings:	P-7419 J.F.M. 10/41 125690# A. B. 8400#	P-7419 J.F.M. 10/41 A.B. 243930#

AMERICAN BUREAU OF SHIPPING,

CHIEF SURVEYOR

By **SURVEYOR**

This Certificate is granted subject to the condition that it is understood and agreed that neither the Bureau nor any of its Committees is under any circumstances whatever to be held responsible for any inaccuracy in any report or certificate issued by this Bureau or its Surveyors or in any entry in the Record or other publication of the Bureau or for any error of judgment, default or negligence of its Officers, Surveyors or Agents.

AMERICAN BUREAU OF SHIPPING

CERTIFICATE NO: P-7422

PORT OF PHILADELPHIA, PA.

EQUIPMENT CERTIFICATE

DATE NOVEMBER 7, 1941

This is to Certify *that the following Equipment has been tested and inspected in accordance with the Rules of this Bureau, at the request of* THE BALDT ANCHOR CHAIN AND FORGE COMPANY, CHESTER, PA., ONE (1) BALDT STOCKLESS ANCHOR OF AN ACTUAL WEIGHT OF 8400 POUNDS (SPECIFIED WEIGHT OF 8400 POUNDS) TO A PROOF STRAIN OF 125690 POUNDS AND ONE (1) 2 9/16" X 17" X 11" PEAR SHAPED LINK TO A PROOF STRAIN OF 243930 POUNDS.

Verified
Starboard Bower Anchor
SS WILLIAM PATTERSON, Hull 2035
AMERICAN BUREAU OF SHIPPING
Surveyor

	Anchor		Pear Shaped Link		
Markings:	P-7422		P-7422	J.F.M.	10/41
	J.F.M.	10/41	A.B.	243930#	
	125690#	A. B.			
	8400#				

AMERICAN BUREAU OF SHIPPING,

CHIEF SURVEYOR

By SURVEYOR

This Certificate is granted subject to the condition that it is understood and agreed that neither the Bureau nor any of its Committees is under any circumstances whatever to be held responsible for any inaccuracy in any report or certificate issued by this Bureau or its Surveyors or in any entry in the Record or other publication of the Bureau or for any error of judgment, default or negligence of its Officers, Surveyors or Agents.

#7

Form AB 130

AMERICAN BUREAU OF SHIPPING

CERTIFICATE NO. PH32307	PORT OF PITTSBURGH

EQUIPMENT CERTIFICATE

DATE JUNE 30, 1947

This is to Certify *that the following Equipment has been tested and inspected in accordance with the Rules of this Bureau, at the request of* PITTSBURGH STEEL FOUNDRY CORPORATION, GLASSPORT, PA.,

ONE (1) POWELL STOCKLESS ANCHOR OF AN ACTUAL WEIGHT OF 7590 POUNDS (SPECIFIED WEIGHT OF 7525 POUNDS) TO A PROOF STRAIN OF 118,000 POUNDS.

Reg. B-WSA1-17147
Sd. W.m. Patterson

Markings: PH32307
P.S.F. 6-47
118000# AB
7590#

AMERICAN BUREAU OF SHIPPING,

CHIEF SURVEYOR

By R. S. Eunson SURVEYOR m.

This Certificate is granted subject to the condition that it is understood and agreed that neither the Bureau nor any of its Committees is under any circumstances whatever to be held responsible for any inaccuracy in any report or certificate issued by this Bureau or its Surveyors or in any entry in the Record or other publication of the Bureau or for any error of judgment, default or negligence of its Officers, Surveyors or Agents

Form AB 130

AMERICAN BUREAU OF SHIPPING

CERTIFICATE NO. P-6901

PORT OF PHILADELPHIA, PA.

EQUIPMENT CERTIFICATE

DATE AUGUST 27, 1941

This is to Certify *that the following Equipment has been tested and inspected in accordance with the Rules of this Bureau, at the request of* BALDT ANCHOR CHAIN & FORGE COMPANY, CHESTER, PA., ONE (1) BALDT STOCKLESS ANCHOR OF AN ACTUAL WEIGHT OF 3195 POUNDS (SPECIFIED WEIGHT OF 3195 POUNDS) TO A PROOF STRAIN OF 61720 POUNDS.

Verified 7-9-42
Stream Anchor
SS WILLIAM PATTERSON, Hull 2053
AMERICAN BUREAU OF SHIPPING
Surveyor

Markings: P-6901

J. F. M. 8/41

61720# A. B.

3195#

AMERICAN BUREAU OF SHIPPING,

D. Arnott
CHIEF SURVEYOR

By Jas F Murray
SURVEYOR

This Certificate is granted subject to the condition that it is understood and agreed that neither the Bureau nor any of its Committees is under any circumstances whatever to be held responsible for any inaccuracy in any report or certificate issued by this Bureau or its Surveyors or in any entry in the Record or other publication of the Bureau or for any error of judgment, default or negligence of its Officers, Surveyors or Agents.

Form AB 13C

AMERICAN BUREAU OF SHIPPING

CERTIFICATE NO.
P-[illegible]145

PORT OF
PHILADELPHIA, PA.

EQUIPMENT CERTIFICATE

DATE JUNE 12, 1942

This is to Certify *that the following Equipment has been tested and inspected in accordance with the Rules of this Bureau, at the request of* BALDT ANCHOR CHAIN & FORGE COMPANY, CHESTER, PA., 240 FATHOMS CONSISTING OF SIXTEEN (16) FIFTEEN (15) FATHOM LENGTHS OF 2 1/16" "DI-LOK" STUD LINK CHAIN, TWO (2) LENGTHS WITH 2 1/8" X 13" X 7 5/8" OVAL END LINK ON ONE (1) END ONLY, AND SIXTEEN (16) 2 1/16" DETACHABLE LINKS TO A BREAKING LOAD OF 341510 POUNDS AND A PROOF STRAIN OF 243920 POUNDS.

SHIP'S COPY

Markings: P-[illegible]145 J. P. N. 6/42
341510# A. B. 243920#
AGG. WT. 60620#

Verified
HAIL CABLE AND CONN. LINKS
SS WILLIAM PATTERSON, Hull 2035

AMERICAN BUREAU OF SHIPPING
Surveyor

AMERICAN BUREAU OF SHIPPING,

CHIEF SURVEYOR

By Jo Murray
SURVEYOR

This Certificate is granted subject to the condition that it is understood and agreed that neither the Bureau nor any of its Committees is under any circumstances whatever to be held responsible for any inaccuracy in any report or certificate issued by this Bureau or its Surveyors or in any entry in the Record or other publication of the Bureau or for any error of judgment, default or negligence of its Officers, Surveyors or Agents.

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